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## CONTENTS

- Art. 1. Observations on the distribution and ecology of the mammals of the cerrado grasslands of central Brazil ..... **Michael A. Mares, Janet K. Braun and D. Gettinger** 1
- Art 2. *Lyreidus alseanus* Rathbun from the Paleogene of Washington and Oregon, U.S.A. .... **Rodney M. Feldmann** 61
- Art. 3. A new species of tiger beetle from India (Coleoptera: Cicindelidae) ..... **Robert E. Acciavatti and Fabio Cassola** 71



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OBSERVATIONS ON THE DISTRIBUTION AND  
ECOLOGY OF THE MAMMALS OF THE CERRADO  
GRASSLANDS OF CENTRAL BRAZILMICHAEL A. MARES<sup>1</sup>

Research Associate, Section of Mammals

JANET K. BRAUN<sup>1</sup>D. GETTINGER<sup>1</sup>

## ABSTRACT

Preliminary distributional and ecological data on the mammal fauna of central Brazil are presented. Small mammals were intensively surveyed on adjacent ecological reserves near Brasília, Federal District, Brazil, between July 1983 and November 1984. We also report results of small mammal surveys in Minas Gerais, Goiás, Mato Grosso, and Mato Grosso do Sul. The vegetation of these five Brazilian states is dominated by cerrado (*sensu lato*), with an upland landscape of xeromorphic grasslands and woodlands, and marshes and lowland gallery forests occurring along the streams and rivers. Data are presented on the habitat preferences, molting patterns, reproduction, ectoparasites, and natural history of all species of cerrado mammals we saw or collected during our research in Brazil. The cerrado is an important and extensive habitat that interconnects many of South America's major phytogeographic areas, including the Amazon rain forest, the Atlantic rain forest, the caatinga, and the chacoan thorn scrub. As such, the cerrado and its mammals could play an important role in the conservation of South America's biota. Thus, further research on cerrado mammals is to be strongly encouraged.

## INTRODUCTION

The Cerrado Province (Cabrera and Willink, 1973) is a major phytogeographic region of South America, associated with the Precambrian plateau in central Brazil (Fig. 1). This diagonal belt of xeromorphic "savannah-like" vegetation separates the Amazonian and Atlantic Coastal forest regions, as well as the semiarid Caa-tinga region of northeastern Brazil and the chacoan thorn scrub of Brazil, Paraguay, Bolivia, and Argentina. Most of the Cerrado Province is situated in Brazil (Sarmiento, 1983) and includes the states of Goiás, Mato Grosso do Sul, southern Mato Grosso, southern Maranhão, southern Piauí, western Bahia, western Minas Gerais, parts of São Paulo and Rondônia, and the Federal District.

The cerrado (*sensu lato*) flora is highly diverse and contains many endemics; Eiten (1978) has reported 230 species of vascular plants from 0.1 ha plots (and 320 species per ha) in the Federal District. Cerrado vegetation occurs primarily in the uplands on well-drained red or yellow latosols that are generally poor in nutrients, especially phosphorous. This xerophyllous savanna is distributed in a mosaic of different physiognomies (below), ranging from open grassland to closed woodlands; the dominant vegetation type is determined by a complex of climatic, edaphic and anthropogenic factors (Alho, 1982; Cole, 1986; Eiten, 1972). In general, the deeper and more well-drained the soil, the higher the density and

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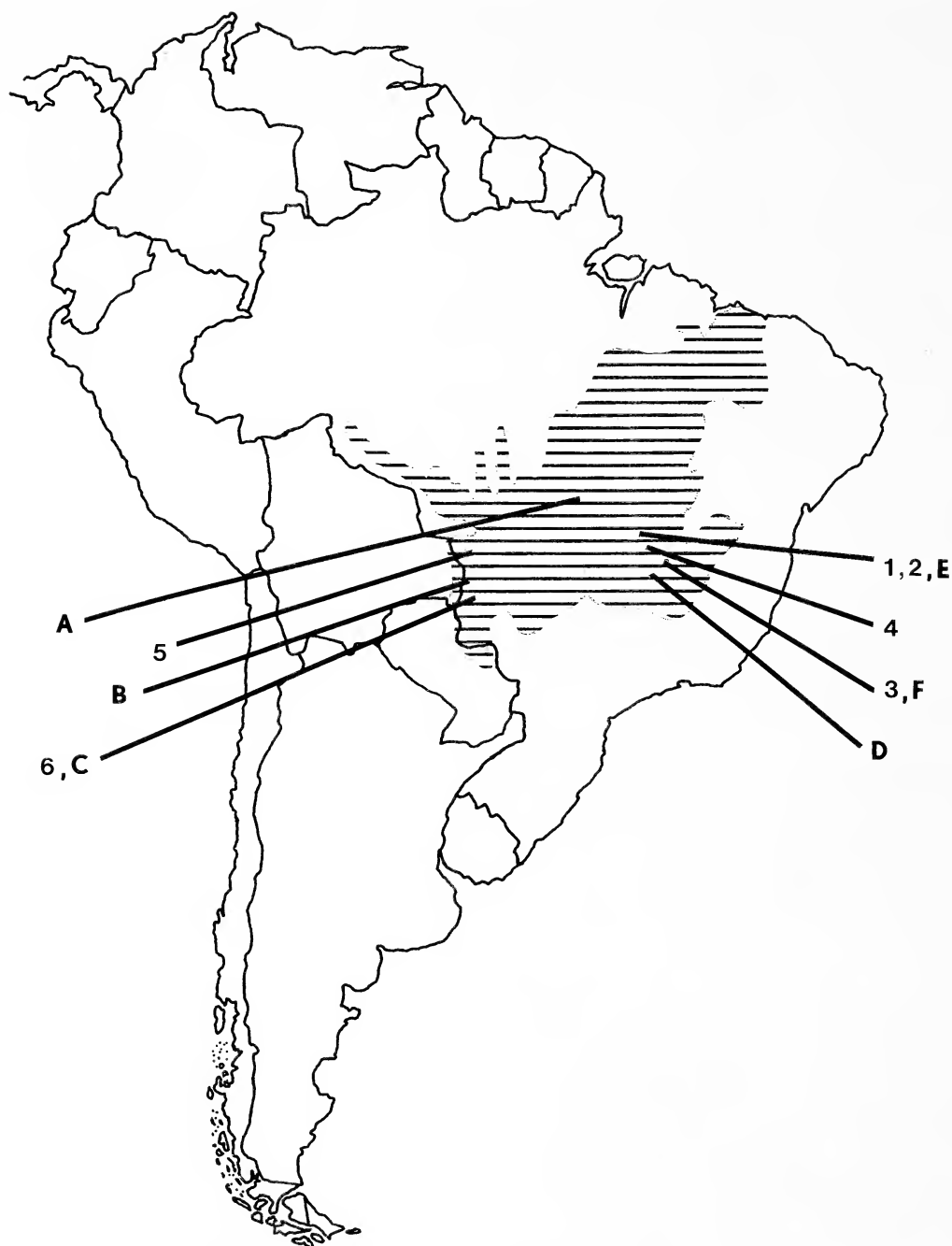


Fig. 1.—A map of the Cerrado Province of South America showing the collecting localities of the specimens reported in this paper. 1) Fazenda Água Limpa (FAL); 2) Reserva Ecológica do Instituto Brasileiro de Geografia e Estatística (IBGE); 3) Estação Ecológica de Pirapitinga, near Tres Marias, Minas Gerais; 4) Cristalina, Goiás; 5) near Poconé, Mato Grosso; 6) Fazenda Nhumirim, Mato Grosso do Sul; A) 264 km N Xavantina, Mato Grosso (Pine et al., 1970; B) Acurizal Ranch, Mato Grosso do Sul (Schaller, 1983); C) Fazenda Nhumirim, Mato Grosso do Sul (Alho et al., 1987; Lacher et al., 1986); D) Serra da Canastra National Park, Minas Gerais (Dietz, 1983; Glass and Encarnação, 1982);

diversity of trees and general ground cover. All of the various physiognomic types of cerrado are related in species composition; for instance, a woody shrub species occurring in campo sujo can usually be found in cerradão, although it may be rare (Eiten, 1984).

The lowland watershed supports marshlands and a mesophytic evergreen forest (in many ways an ecotonal forest between the Amazon and Atlantic rain forests) (Cerqueira, 1982; Fonseca and Redford, 1984); there is often a distinct boundary between these habitats and the upland cerrado vegetation.

The climate of the cerrado is highly seasonal, with rain falling principally from January through July and a pronounced five-month dry season that lasts from August through December. Average yearly maximum temperature (near Brasília) is about 28°C, while the average minimum is about 12°C (Eiten, 1984). The northern portions of the cerrado, and the pantanal, are warmer (Nimer, 1972). Temperatures are warmest during the late dry season (September, October), with the maximum recorded temperature near Brasília being 34.5°C, and the lowest recorded temperature in the same area being 1.6°C (IBDF, 1979). Temperature extremes are greater in the pantanal, where a high temperature of 42°C and a low of 0°C have been recorded (Nimer, 1972; Valverde, 1972). Annual precipitation varies from about 1250 mm in the pantanal to almost 2000 mm in the ecotonal region of the northern cerrado where it grades into the Amazonian rain forest (Nimer, 1972). Precipitation near Brasília averages 1586 mm (Eiten, 1984).

The mammals of the cerrado have not been well studied. There has been some basic research on systematics and distribution of cerrado mammals (e.g. Alho, 1982; Alho et al., 1987; Avila-Pires, 1957, 1968, 1972; Costa et al., 1981; Fonseca and Redford, 1984; Glass and Encarnação, 1982; Lacher et al., 1986; Macêdo and Mares, 1987; Mello and Moojen, 1979; Moojen, 1965; Pine et al., 1970; Sazima et al., 1978; Schaller, 1983; Sick, 1965; Varejão and Valle, 1982; Vieira, 1955), on mammals associated with plague or other human diseases (e.g. Araújo and Sherlock, 1969; Gettinger, 1987; Guimarães, 1972; Lainson and Shaw, 1969; Pollitzer and Meyer, 1965), and on basic ecology of mammals (e.g. Alho, 1979a, 1979b, 1980, 1981a, 1981b, 1981c, 1986; Alho and Souza, 1982; Borchert and Hansen, 1983; Dietz, 1983; Ernest and Mares, 1986; Fonseca and Lacher, 1984; Fonseca et al., 1982; Lacher et al., 1984, in press; Mares et al., 1986; Mello, 1977, 1980; Nitikman and Mares, 1987; Paula, 1983; Redford, 1984a, 1984b, 1985a, 1985b; Sazima and Sazima, 1975; Shaw et al., 1985; Souza and Alho, 1980; Valle et al., 1982). For a region that is the second most extensive habitat in South America after the Amazon rain forest, and that encompasses more than 1.9 million km<sup>2</sup> (including the pantanal), the cerrado has been poorly collected. Moreover, most studies on the ecology of cerrado mammals have been conducted near Brasília and have been carried out since the founding of that city in the late 1950s. Patterns of faunal distribution within the region, as well as the selection of microhabitats by mammal species, have not yet been adequately described (e.g., Lacher and Mares, 1986; Lacher et al., 1986; Mares, 1982a; Pine, 1982).

During 1983–84, we conducted ecological research on small mammals of the cerrado near Brasília, Federal District, and, as an adjunct to that research, collected small mammals in various habitats of the cerrado and pantanal. Because infor-

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E) near Formosa, Goiás (Mello, 1977, 1980; Mello and Moojen, 1979); F) Prudente de Moraes, Minas Gerais (Valle et al., 1982) and Serra do Cipó (Sazima and Sazima, 1975).



Fig. 2.—Campo limpo habitat from the southern border of the Fazenda Água Limpa, Federal District, Brazil.

mation based on collected specimens is so rare in this vast region, we present herein information on the distribution, ecology, systematics, and morphometrics of the mammals collected or, in the case of larger species, seen by us during our research in Brazil.

Among the cerrado's many habitats are a number of major types that we sampled for mammals. We list only those habitats for which we have some associated information on mammals. Our research was not designed to sample the entire fauna of the cerrado, but will provide some foundational information on occurrence and habitat selection.

#### STUDY AREAS

*Description of the Upland Habitats.* — **Campo limpo** ("clean field") is open grassland with variable densities of grasses, sedges (in moist areas), forbs, and small shrubs. These campos have a homogeneous appearance with no woody vegetation extending above the grass. Campo limpo often occurs on plateaus and hilltops in areas of shallow soil, where the grass-forb canopy is low and sparse. It also can occur at lower elevations, often grading into seasonal wet campos (Fig. 2).

**Campo sujo** ("dirty field") is grassland with some scattered woody plants or palm-like species emerging above the grass cover. This habitat is characterized by less than 10% total ground cover by woody species and often occurs in areas of shallow soil with the well-dispersed shrubs and trees taking root in cracks in the bedrock (Eiten, 1984).

**Cerrado** (*sensu stricto*, "closed") is a semideciduous, xeromorphic tree/shrub woodland with an open canopy and a ground-cover of forbs and grasses. This habitat occurs in a broad range of tree/shrub densities, with total ground cover ranging from 10–60% (Eiten, 1984) and with woody species widely spaced. Av-





Fig. 3.—Cerrado from the southeast corner of the Reserve Ecológica do Instituto Brasileiro de Geografia e Estatística, Federal District, Brazil.

erage height of the tree canopy ranges from 6–8 m (Eiten, 1984; Goodland, 1971; Goodland and Ferri, 1979; Fig. 3).

**Cerradão** (“big cerrado”) is a xeromorphic, semideciduous upland forest of moderately tall trees, with a closed to semi-closed canopy. It occurs in areas of deep soil, rich in nutrients; the tree canopy often reaches nine meters (Goodland, 1971). Development of a more closed canopy shades the forest floor, producing a sparsely covered understory.

**Campo rupestre** (“rocky field”) is a habitat associated with areas of outcrops of bedrock. It occurs in the highlands, on plateau tops and ridges, usually between 1000 and 1800 m elevation (Eiten, 1972). This habitat occurs on special (non-latosol) rock types, often with adjacent seepage areas and seasonal wet campos. The flora has not been studied, but includes both typical cerrado species and endemics, typified by many species of the family Velloziaceae (Fig. 4).

**Upland mesophytic forest** occurs on rich, well-drained latosols or patches of limestone-based soils. These forests are evergreen to semideciduous, often with a well-developed and stratified canopy. The floral composition is often quite different than that of typical cerrado, but may grade into cerrado or cerradão at the perimeter.

*Description of the Lowland Habitats.*—**Gallery forest** is evergreen mesophytic forest found along the drainage lowlands. It usually occurs along streams and rivers where the water table is close to the surface, but may continue up the slope of the valley in areas where there is well-drained soil of enhanced fertility (Eiten, 1972, 1984). The forest canopy is often dense and stratified. There is a sharp boundary between gallery forest and the xeromorphic cerrado vegetation (Fig. 5).

**Brejo** is a grass-sedge marshland that occurs in areas where the soils are gleyed and the ground surface is permanently saturated. This habitat often occurs in long sections of the valley lowlands instead of gallery forest (“veredas”), or as a rounded



Fig. 4.—Rocky outcropping of campo rupestre habitat located southeast of Cristalina, Goiás, Brazil.



Fig. 5.—A gallery forest located in the ecological reserve of the Fazenda Água Limpa, Federal District, Brazil.



Fig. 6.—An extensive area of lowland brejo habitat near the northern border of the Fazenda Água Limpa, Federal District, Brazil.

depression at the head (“cabeceira”) of a gallery forest. This hydric plant community is poorly known, and does not share species with the cerrado (Goodland, 1971; Fig. 6).

**Wet campo** is a seasonal marsh habitat occurring on gleyed soils that alternate seasonally between being dry and being saturated. These campos often form a boundary strip between the gallery forest and the upland cerrados that ranges “from a few meters to several hundred meters wide” (Eiten, 1972, 1984). Buriti palms (*Mauritia vinifera*) are often associated with forest/marsh boundaries. This habitat also occurs in association with campo limpo on upland scarps and hillsides, where ground water flushes downward near the soil surface.

**The Pantanal.**—The pantanal is an extensive (400,000 km<sup>2</sup>) area of seasonal marshes occupying the flat upper watershed of the Paraguay River in southwestern Mato Grosso and northwestern Mato Grosso do Sul (Fig. 7). Floristically, the pantanal is a mosaic of several vegetation types, bordered on the northwest by semideciduous forest that forms a transitional zone with Amazonian forest, on the southwest by xeric chaco, and on the east by the cerrado. Vast areas of this landscape are inundated during the rainy season, leaving only isolated hills and ridges above the water table. Permanent and seasonal marsh are interspersed with uplands supporting typical cerrado vegetation or semideciduous subtropical forest; gallery forests sometimes occur along the streams and rivers (Alho et al., 1988; Valverde, 1972).

**Collecting Localities in the Federal District.**—Most of the small mammals reported in this paper were collected on or near two ecological reserves south of Brasília, Federal District, Brazil (15°57'S, 47°54'W, elevation 1100 m).

1. Fazenda Água Limpa (FAL) is an agricultural research station and ecological reserve of the Universidade de Brasília. The central laboratory facilities are located approximately 12 km S Brasília. The reserve has been protected from most human disturbance during the last 20 years, but human-caused fires are common during the dry season. Cerradão, cerrado (*sensu stricto*), campo sujo, campo



Fig. 7.—The pantanal, an area typified by extensive permanent and seasonally inundated marshlands. This photograph was taken near Corumbá, Mato Grosso do Sul, Brazil.

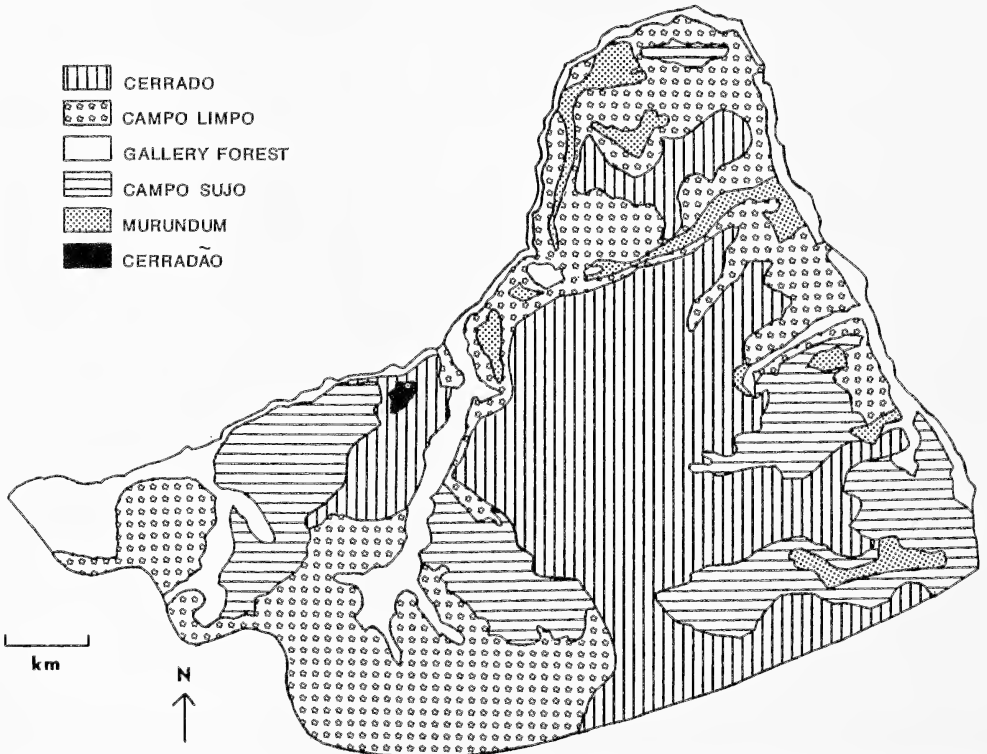


Fig. 8.—A simplified map of the major cerrado (*sensu lato*) habitats represented within the Fazenda Água Limpa (taken from Ratter, 1980).



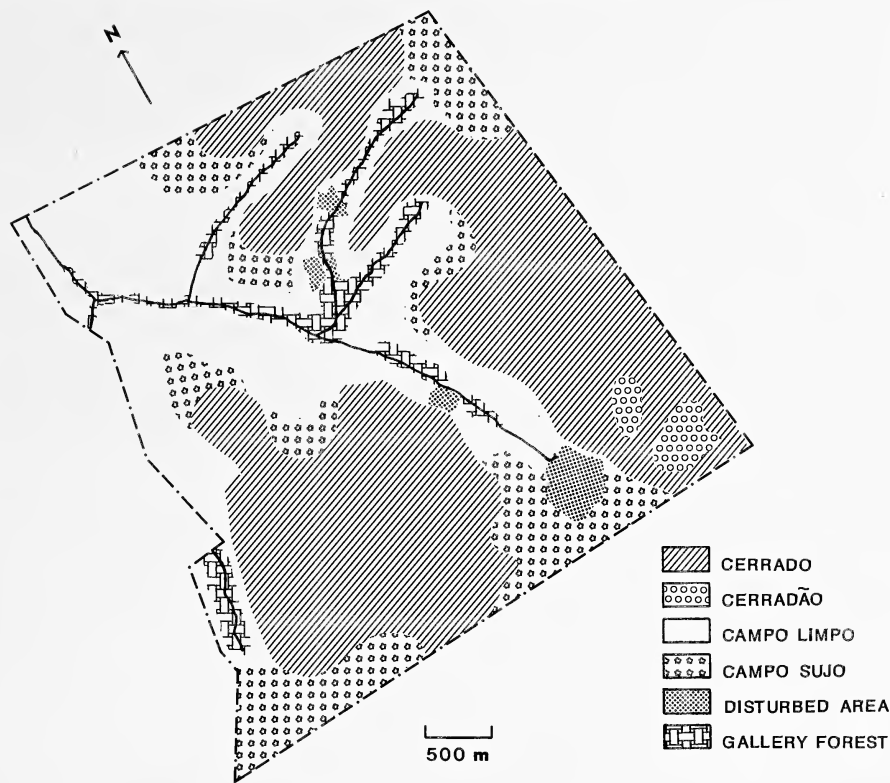


Fig. 9.—A simplified map of the major cerrado (*sensu lato*) habitats represented within the Reserva Ecológica do Instituto Brasileiro de Geografia e Estatística (after Negret, 1983).

limpo, valley-side wet campo, brejo, and gallery forest habitats were all represented at FAL, while upland mesophytic forest and campo rupestre habitats were absent (Fig. 8).

2. Reserva Ecológica do Instituto Brasileiro de Geografia e Estatística (IBGE) is located 35 km S Brasília. IBGE maintains a permanent fire break around the perimeter of the reserve, and had protected its habitats from fire for more than eight years prior to this study. All major cerrado habitats (except upland mesophytic forest and campo rupestre) were represented on the reserve (Fig. 9).

*Other Localities in the Cerrado Province.*—3. Estação Ecológica de Pirapitinga, near Tres Marias, Minas Gerais. This reserve is located on a peninsula extending into a large reservoir at Tres Marias. The peninsula is isolated from the mainland during the rainy season (thus, seasonally it becomes an island). Habitats present included cerrado, cerradão, and semideciduous forest.

4. Cristalina, Goiás. The habitats of this area are very similar to those found in the Federal District, but include abundant campo rupestre intergrading with cerrado.

5. Near Poconé, Mato Grosso. Pantanal. IBDF reserve. This habitat is described in Alho et al. (1988).

6. Mato Grosso do Sul. Pantanal. Fazenda Nhumirim, 150 km SE of Corumbá; research ranch of the Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Centro de Pesquisa Agropecuária de Pantanal. Alho et al. (1988) described the habitats of the southern pantanal and Lacher et al. (1986) provide a detailed description of the habitats of the Fazenda Nhumirim.

## MATERIALS AND METHODS

Mammals were collected as part of an ecological study of small mammals in the Brazilian cerrado during 1983–84. Small mammals were collected using Sherman (23 by 8 by 9 cm) and Tomahawk (48 by 15 by 15 cm) live traps, snap traps and rat traps; bats were collected by mist netting. Traps were set in grid arrays in areas of intensive ecological research and were checked for several days each month, depending upon the grid study in progress (e.g. Ernest and Mares, 1986; Lacher et al., in press;

Mares et al., 1986; Nitikman and Mares, 1987). Traps were also placed in no particular pattern in various habitats in order to sample small mammals. Animals captured alive were anesthetized with ether so that a sample of ectoparasites could be obtained. Animals were brushed over a porcelain tray; chiggers and ticks were removed with fine forceps. Ectoparasites were stored in vials of 70% ethyl alcohol. Further description of this technique is given by Gettinger (1987). Specimens were examined for reproductive condition at the time of preparation. Molting patterns were determined by examining the skins during preparation.

### CHECKLIST OF MAMMALS OF THE FEDERAL DISTRICT

Since our most intensive research effort was limited to the Federal District near Brasília, in the center of the cerrado, we here provide a list (Table 1) of the fauna that is found in that area. While we were not able to verify all species listed, we also include those that had been reported earlier and are based on museum specimens or sightings of easily identifiable species. The list includes species comprising genera, families, and orders known or expected in the Federal District.

### ACCOUNTS OF SPECIES

The species accounts include all species which we have observed or collected at our intensive study site in the Federal District and in various localities throughout the cerrado and pantanal. We do not include species that have been cited by others but for which we have no firsthand information. The species accounts which follow include the order and family of each species, as well as the scientific name followed by the authority and literature citation for the binomial. Measurements are in mm and body mass is given in grams. The following measurements are reported: total length (ToL), tail length (TL), hind foot length (HF), ear length (E), weight (WT), greatest length of skull (GLS), basilar length (BL), braincase breadth (BB), interorbital breadth (IB), mastoid breadth (MB), zygomatic breadth (ZB), nasal length (NL), diastema length (DL), palatal length (PL), maxillary toothrow length (MTRL). Forearm length (FL) is reported for bats. Crown rump length (CRL) of embryos is given in mm. Specimens are housed in the Oklahoma Museum of Natural History, University of Oklahoma, Norman, Oklahoma (OMNH), the Departamento de Biologia Animal, Universidade de Brasília, Brasília, Brazil (UNB), or the Instituto Brasileiro de Geografia e Estatística, Brasília, Brazil (IBGE). Orders, families, and subfamilies are listed in phylogenetic order (Anderson and Jones, 1984), while genera (taxonomy following Anderson and Jones, 1984) and species (taxonomy following Honacki et al., 1982) are listed alphabetically. Morphological measurements are listed in tables; information on reproduction, molt, habitat and other aspects of the biology of a species are given in the species account.

Order Marsupialia  
Family Didelphidae  
Subfamily Didelphinae

#### *Chironectes minimus* (Zimmermann)

1780. *Lutra minima* Zimmermann, Geogr. Gesch. Mensch. Vierf. Thiere, 2:317.

*Ectoparasites*.—The following ectoparasites were collected from this species: Parasitiformes (*Amblyomma* sp., *Androlaelaps fahrenheitsi* (Berlese)).

*Remarks*.—One individual was captured in February, 1984, along a gallery forest stream at IBGE. It was examined, marked and released.

*Didelphis albiventris* Lund

1840. *Didelphis albiventris* Lund, Kongl. Dansk. Vid. Naturv. Math. Selsk. Afhandl., p. 20.

*Specimens examined* (13).—FEDERAL DISTRICT: 12 km S Brasília, 1 (UNB); 17 km S Brasília, 1 (UNB), 1 (IBGE); 20 km S Brasília, 5 (OMNH), 2 (UNB); 25 km S Brasília, 1 (OMNH), 2 (UNB).

*Measurements*.—See Table 2.

*Reproduction*.—Two adult males were collected, one each in July and October; subadult males were collected in March ( $n = 1$ ) and December ( $n = 2$ ). Two adult females were collected in July; both were pregnant with seven young in the pouch (mean CRL 23 and 25 mm). Subadult females were caught in March ( $n = 2$ ), May ( $n = 1$ ), July ( $n = 1$ ), November ( $n = 1$ ) and December ( $n = 1$ ).

*Molt*.—One of the four adults showed no sign of molt; data are not available for the other three adults. Juveniles and subadults collected in March ( $n = 3$ ), November ( $n = 1$ ) and December ( $n = 1$ ) were in various stages of molt. Additional juveniles and subadults collected in May ( $n = 1$ ) and December ( $n = 1$ ) were not molting; data are not available for an individual collected in July and one collected in December.

*Ectoparasites*.—The following ectoparasites were collected from this species: Siphonaptera (*Polygenis* sp.); Parasitiformes (*Gigantolaelaps goyanensis* Fonseca, *G. oudemansi* Fonseca, *Androlaelaps fahrenheitsi* (Berlese), *Ixodes* sp., *Amblyomma* sp.); Acariformes (undetermined species).

*Habitat*.—These large marsupials were captured in all the major habitats including cerrados (cerrado, cerradão), campos (campo limpo, campo sujo), brejos, gallery forests (Mares et al., 1986) and wet campos. Eleven of the specimens were collected on the ground in gallery forests. Two specimens were found as road kills. Two specimens (juveniles) were trapped in Sherman traps; all other specimens were trapped in Tomahawk traps.

*Remarks*.—Although this species was usually captured on the ground, it also forages in trees. Small subadults were occasionally captured in arboreal Sherman traps and, when Tomahawk traps were placed up in flowering *Caryocar brasiliensis*, *D. albiventris* adults were captured. Fonseca and Redford (1984) reported that this species has been trapped in all habitat types except open fields on the IBGE Reserve. Alho (1981a) also found this species common at FAL. Fonseca et al. (1982) captured *D. albiventris* in gallery forest, cerrado, cerradão and dry forest in the Federal District and noted its lack of habitat specificity. Paula (1983) found this species in the gallery forest of the National Park of Brasília. This species was captured in gallery forest and cerradão in the Federal District, Mato Grosso and at several sites in Goiás (Mello, 1980; Mello and Moojen, 1979; Schaller, 1983; Valle et al., 1982).

*Marmosa agilis* (Burmeister)

1854. *Grymaeomys agilis* Burmeister, Syst. Übers. Thiere Bras., 1:139.

*Specimens examined* (38).—FEDERAL DISTRICT: 20 km S Brasília, 10 (OMNH), 8 (UNB); 25 km S Brasília, 5 (OMNH), 8 (UNB); 15 km S, 3 km E Brasília, 1 (IBGE); 20 km SW Brasília, 1 (UNB). GOIÁS: 12 km NE Cristalina, 1 (UNB). MATO GROSSO: 108 km S Poconé, 1 (OMNH); 115 km S Poconé, 3 (OMNH).

*Measurements*.—See Table 2.

*Reproduction*.—Males collected in February ( $n = 1$ ), May ( $n = 2$ ), July ( $n = 3$ ) and September ( $n = 2$ ) were adults and had scrotal testes. Juvenile and subadult males were collected in January ( $n = 4$ ), February ( $n = 3$ ), April ( $n = 2$ ), May ( $n$

Table 1.—Checklist of the mammals of the Federal District. The status of each species is indicated as being: (\*) collected, trapped and released or seen by us; (\*\*) tracks or field sign seen by us; (1) collected and/or seen by Fonseca and Redford (1984); (2) collected and/or seen by Paula (1983); reported by (3) Moojen (1965); (4) Avila-Pires (1972); (5) Mello and Moojen (1979); (6) Borchert and Hansen (1983); (7) Coimbra et al. (1982); (8) IBDF (1979).

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Order Marsupialia	
Family Didelphidae	
Subfamily Didelphinae	
<i>Chironectes minimus</i>	*
<i>Didelphis albiventris</i>	*, 1, 2, 5
<i>Marmosa agilis</i>	*
<i>Marmosa murina</i>	1, 2, 5
<i>Marmosa</i> sp.	*
<i>Monodelphis americana</i>	*, 2
<i>Monodelphis domestica</i>	*, 1 <sup>a</sup>
<i>Monodelphis kunsii</i>	*
<i>Philander opossum</i>	2, 5
Order Chiroptera	
Family Emballonuridae	
Subfamily Emballonurinae	
<i>Peropteryx macrotis</i>	7
<i>Rhynchonycteris naso</i>	7
Family Phyllostomidae	
Subfamily Phyllostominae	
<i>Chrotopterus auritus</i>	7
Subfamily Glossophaginae	
<i>Anoura caudifer</i>	*
<i>Glossophaga soricina</i>	*, 7
Subfamily Carolliinae	
<i>Carollia perspicillata</i>	*, 7
Subfamily Stenoderminae	
<i>Artibeus cinereus</i>	*
<i>Artibeus literatus</i>	*, 7
<i>Chiroderma doriae</i>	7
<i>Sturnira lilium</i>	*
<i>Vampyrops lineatus</i>	*
Subfamily Desmodontinae	
<i>Desmodus rotundus</i>	*, 7
Family Furipteridae	
<i>Furipterus horrens</i>	7
Family Vespertilionidae	
Subfamily Vespertilioninae	
<i>Eptesicus brasiliensis</i>	*
<i>Myotis nigricans</i>	*
Family Molossidae	
<i>Molossus molossus</i>	*
<i>Nyctinomops laticaudatus</i>	*
Order Primates	
Family Cebidae	
Subfamily Cebinae	
<i>Cebus apella</i>	*, 1

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Table 1.—Continued.

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Subfamily Alouattinae	
<i>Alouatta caraya</i>	*
Subfamily Callitrichinae	
<i>Callithrix jacchus</i>	*, 1 <sup>b</sup> , 8 <sup>b</sup>
Order Xenarthra	
Family Dasypodidae	
<i>Cabassous unicinctus</i>	*, 1
<i>Dasypus novemcinctus</i>	*, 1, 8
<i>Dasypus septemcinctus</i>	*
<i>Euphractus sexcinctus</i>	*, 1, 8
<i>Priodontes maximus</i>	***, 1, 8
<i>Tolypeutes tricinctus</i>	8
Family Myrmecophagidae	
<i>Myrmecophaga tridactyla</i>	8
<i>Tamandua tetradactyla</i>	1, 8
Order Lagomorpha	
Family Leporidae	
<i>Sylvilagus brasiliensis</i>	*, 1, 8
Order Rodentia	
Family Muridae	
Subfamily Sigmodontinae	
<i>Akodon cursor</i>	*, 5 <sup>c</sup> , 6
<i>Akodon reinhardti</i>	*
<i>Akodon</i> sp. 1	*
<i>Akodon</i> sp. 2	*
<i>Bolomys lasiurus</i>	*, 1, 2, 5 <sup>c</sup> , 6 <sup>c</sup>
<i>Calomys callosus</i>	*, 1, 5 <sup>d</sup> , 6
<i>Calomys tener</i>	*, 5 <sup>d</sup>
<i>Holochilus brasiliensis</i>	5
<i>Juscelinomys candango</i>	3, 5
<i>Kunsia fronto</i>	4, 5
<i>Nectomys squamipes</i>	*, 1, 2, 5
<i>Oryzomys bicolor</i>	*
<i>Oryzomys capito</i>	*
<i>Oryzomys concolor</i>	*
<i>Oryzomys fornesi</i>	*, 2 <sup>c</sup> , 5 <sup>c</sup> , 6 <sup>c</sup>
<i>Oryzomys lamia</i>	5
<i>Oryzomys nigripes</i>	*, 2 <sup>c</sup> , 5 <sup>c</sup> , 6 <sup>c</sup>
<i>Oryzomys subflavus</i>	*, 1, 2, 5
<i>Oryzomys utiariensis</i>	5 <sup>f</sup>
<i>Oxymycterus roberti</i>	*, 1, 2, 5, 6
<i>Plectomys paludicola</i>	2, 6
<i>Pseudoryzomys</i> (= <i>Oecomys</i> ) <i>simplex</i>	1, 2, 5
<i>Rhipidomys mastacalis</i>	*, 2, 5 <sup>g</sup>
<i>Rhipidomys</i> sp.	1
Subfamily Murinae	
<i>Mus musculus</i>	*
<i>Rattus rattus</i>	*
Family Erethizontidae	
<i>Coendou prehensilis</i>	*

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Table 1.—Continued.

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Family Caviidae	
Subfamily Caviinae	
<i>Cavia aperea</i>	*, 2, 5, 8
<i>Galea spixii</i>	5
Family Hydrochaeridae	
<i>Hydrochaeris hydrochaeris</i>	**, 1, 5, 8
Family Dasyproctidae	
<i>Dasyprocta</i> sp.	*, 1
Family Echimyidae	
Subfamily Echimyinae	
<i>Carterodon sulcidens</i>	5
<i>Clyomys laticeps</i>	5
<i>Proechimys longicaudatus</i>	1, 2, 5
<i>Proechimys</i> sp.	*
<i>Thrichomys apereoides</i>	*, 1, 5
Order Carnivora	
Family Canidae	
Subfamily Caninae	
<i>Cerdocyon thous</i>	8
<i>Chrysocyon brachyurus</i>	*, 1, 8
<i>Speothos venaticus</i>	1
Family Procyonidae	
Subfamily Procyoninae	
<i>Nasua nasua</i>	**, 8
<i>Procyon cancrivorus</i>	8
Family Mustelidae	
Subfamily Mustelinae	
<i>Eira barbara</i>	*, 1, 8
Family Felidae	
Subfamily Felinae	
<i>Felis concolor</i>	8
<i>Felis pardalis</i>	8
<i>Felis yagouaroundi</i>	1
Order Perissodactyla	
Family Tapiridae	
<i>Tapirus terrestris</i>	8
Order Artiodactyla	
Family Tayassuidae	
<i>Tayassu tajacu</i>	8
<i>Tayassu pecari</i>	8
Family Cervidae	
Subfamily Odocoileinae	
<i>Mazama americana</i>	1, 8
<i>Ozotoceros bezoarticus</i>	*, 1, 8

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<sup>a</sup> This species is listed as *Monodelphis* sp.<sup>b</sup> This species is listed as *C. penicillata*.<sup>c</sup> This species is listed as *Zygodontomys lasiurus*; the specimens collected in the gallery forest are probably *Akodon cursor*; all specimens except those from the gallery forest are probably *B. lasiurus*.<sup>d</sup> Mello and Moojen (1979) combined these two species under *Calomys callosus*.<sup>e</sup> This species is listed as *O. elurus*; those specimens collected in the campos are probably *O. fornesi* and those collected in the gallery forest are probably *O. nigripes*.

= 1), August ( $n = 1$ ) and December ( $n = 2$ ). Adult females were captured in February ( $n = 1$ ), September ( $n = 2$ ) and October ( $n = 5$ ); three of those collected in October were lactating. Juvenile and subadult females were collected in February ( $n = 2$ ), March ( $n = 1$ ), April ( $n = 5$ ) and May ( $n = 1$ ).

*Molt*.—An adult collected in February was molting behind the ears, postero-dorsally and beneath the fore and hind limbs ventrally. One adult taken in July had a spotty ventral molt, while an adult caught in October showed a single small dorsal patch of active melanin deposition. None of the other adults showed signs of molt. Juveniles and subadults collected in January ( $n = 2$ ), February ( $n = 4$ ), May ( $n = 1$ ), August ( $n = 1$ ), and December ( $n = 2$ ) were in various stages of molt ranging from complete dorso-ventral molt to small patches on the dorsum and venter.

*Ectoparasites*.—The following ectoparasites were collected from this species: Parasitiformes (*Ixodes* sp.); Acariformes (undetermined species).

*Habitat*.—This species is almost exclusively arboreal and found only in the gallery forest, albeit in a variety of gallery forest microhabitats (Nitikman and Mares, 1987). Only six specimens were collected in the gallery forest in terrestrially set traps. Two specimens, one (in the UNB collection) collected at Cristalina and one (in the IBGE collection) collected 15 km S and 3 km E Brasília are identified as *M. agilis*. Both were trapped in cerrado habitat. Additional collections of *Marmosa* need to be made in the cerrado in order to clarify its distribution among habitats.

*Remarks*.—Dietz (1983) captured a single individual during an ecological study in Minas Gerais. Pine et al. (1970) reported collecting several species of *Marmosa* north of Xavantina in Mato Grosso. Mello and Moojen (1979) reported collecting *M. murina* in the Federal District; these specimens may be *M. agilis*.

### *Marmosa* sp.

*Specimens examined* (1).—FEDERAL DISTRICT: 25 km S Brasília, 1 (OMNH).

*Measurements*.—See Table 2.

*Reproduction*.—The single adult male captured in September had large scrotal testes.

*Molt*.—The specimen collected on 1 September was molting mid-ventrally, with isolated small patches of melanic spotting on the dorsum.

*Habitat*.—This specimen was collected in the gallery forest in a Sherman trap set one foot above the ground.

*Remarks*.—We have not as yet been able to identify this species.

### *Monodelphis americana* (Müller)

1776. *Sorex americanus* Müller, Natursyst. Suppl., 7:36.

*Specimens examined* (14).—FEDERAL DISTRICT: 20 km S Brasília, 6 (OMNH), 6 (UNB), 1 (IBGE); 25 km S Brasília, 1 (OMNH).

*Measurements*.—See Table 2.

*Reproduction*.—One adult male collected in July had large scrotal testes. Two adult females were caught, one each in March and November; the latter was

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<sup>†</sup> This species may be a composite species (*fornesi* and *nigripes*); see Myers and Carleton (1981) for a discussion.

<sup>\*</sup> This listing includes *R. macrurus* and *R. mastacalis* of Mello and Moojen (1979).

Table 2.—External, cranial and dental measurements (in millimeters) of marsupial species. See the introduction to the Accounts of Species for an explanation of the abbreviations. The mean and observed range are given for each measurement.

	ToL	TL	HF	E	WT	GSL	BL
<i>Didelphis albiventris</i>							
Adult males, 2	703.5 (700-707)	316.0 (314-318)	50.5 (50-51)	56.0 (55-57)	1000+	98.3	88.3
Adult females, 2	680.5 (656-705)	322.0 (305-339)	46.5 (45-48)	56.0 (52-60)	(955-1000+)	91.0 (86.4-95.5)	83.7 (80.4-87.0)
Subadults, 9 (3 males, 6 females)	470.3 (300-590)	233.8 (152-309)	36.9 (23-46)	45.0 (37-53)	337.5 (70.5-590)	63.0 (43.0-76.0)	56.5 (38.2-69.4)
<i>Marmosa agilis</i>							
Adult males, 8	225.6 (203-250)	133.7 (121-143)	15.5 (13-18)	20.4 (19-21)	25.5 (19.5-33.5)	28.9 (27.9-31.3)	24.9 (23.9-27.3)
Adult females, 8	229.9 (219-242)	125.6 (115-135)	15.1 (12-17)	19.9 (18-22)	26.1 (21.0-32.9)	28.9 (28.0-29.7)	25.2 (24.4-26.0)
Subadults, 22 (13 males, 9 females)	197.3 (164-235)	113.6 (95-132)	15.1 (13-18)	19.3 (16-22)	15.1 (8.5-18.0)	26.5 (23.0-29.8)	22.6 (19.2-25.8)
<i>Marmosa</i> sp.							
Adult males, 1	201.0	91.0	13.0	19.0	35.9	29.4	26.2
<i>Monodelphis americana</i>							
Adult males, 1	139.0	46.0	18.0	14.0	19.5	28.2	25.0
Adult females, 2	167.5 (160-175)	50.0 (49-51)	17.5 (17-18)	14.5 (14-15)	32.8 (32.5-33.0)	30.9 (30.4-31.4)	28.0 (27.6-28.4)
Subadults, 11 (5 males, 6 females)	120.8 (100-137)	35.5 (31-44)	14.4 (12-16)	11.0 (8-14)	14.0 (9.0-17.0)	25.5 (22.7-27.6)	22.5 (19.4-24.7)
<i>Monodelphis domestica</i>							
Adult females, 2	177.5 (175-180)	61.5 (58-65)	17.5 (17-18)	21.0 (20-22)	39.3 (32.0-46.5)	33.1 (32.3-33.9)	30.1 (29.1-31.0)
<i>Monodelphis kunsii</i>							
Adult males, 2	113.5 (113-114)	37.0 (36-38)	12.0 (10-14)	10.5 (10-11)	11.3 (8.5-14.0)		
<i>Philander opossum</i>							
Adult males, 1	568.0	280.0	42.0	38.0	430.0	72.0	65.5
Adult females, 1	595.0	295.0	43.0	39.0	400.0	71.4	65.6

Table 2.—Continued.

	BB	IB	MB	ZB	PL	MTRL
<i>Didelphis albiventris</i>						
Adult males, 2	27.3	9.5	31.1	54.0	52.3	33.9
Adult females, 2	26.9 (26.1–27.6)	9.8 (9.7–9.8)	26.3 (23.7–28.8)	47.4 (45.5–49.3)	51.6 (49.0–54.1)	33.6 (32.4–34.8)
Subadults, 9 (3 males, 6 females)	19.3 (16.1–21.5)	9.4 (8.8–9.8)	20.5 (14.9–24.0)	33.6 (22.9–41.0)	35.5 (25.3–43.7)	23.8 (15.8–32.1)
<i>Marmosa agilis</i>						
Adult males, 8		4.7 (4.3–5.3)	11.0 (10.7–11.3)	15.5 (14.8–16.5)	14.4 (13.9–15.6)	11.1 (10.7–11.4)
Adult females, 8		4.9 (4.7–5.3)	11.0 (10.8–11.5)	16.1 (15.5–16.9)	14.4 (13.8–14.7)	10.7 (10.4–11.0)
Subadults, 22 (13 males, 9 females)		4.6 (4.3–5.1)	10.5 (9.6–11.2)	14.3 (12.2–16.5)	13.3 (11.5–14.7)	10.3 (9.0–10.9)
<i>Marmosa</i> sp.						
Adult males, 1	10.2	3.9	10.7	16.2	15.1	10.9
<i>Monodelphis americana</i>						
Adult males, 1	11.2	5.5	8.9	14.5	14.5	11.5
Adult females, 2	11.0 (10.9–11.0)	5.5 (5.4–5.5)	11.8 (11.5–12.1)	16.4 (16.0–16.8)	16.0 (15.8–16.1)	11.9 (11.7–12.0)
Subadults, 11 (5 males, 6 females)	10.3 (9.6–11.7)	5.2 (4.8–5.5)	10.3 (9.6–10.9)	13.4 (12.1–14.2)	13.2 (11.7–14.5)	10.7 (8.8–11.5)
<i>Monodelphis domestica</i>						
Adult females, 2	11.8 (11.7–11.9)	5.7 (5.5–5.8)	12.8	17.7 (17.5–17.9)	17.9 (17.3–18.4)	14.0
<i>Monodelphis kunsi</i>						
Adult males, 2						
<i>Philander opossum</i>						
Adult males, 1	20.0	7.9	22.1	36.2	40.1	29.6
Adult females, 1	21.9	8.2	22.3	37.6	40.3	29.3

lactating. Subadult males were collected in March ( $n = 2$ ), May ( $n = 2$ ) and June ( $n = 1$ ). Subadult females were collected in February ( $n = 3$ ), March ( $n = 2$ ) and May ( $n = 1$ ).

*Molt.*—Molting adult animals were recorded in the months of March ( $n = 1$ ), July ( $n = 1$ ), and November ( $n = 1$ ). Molting juveniles and subadults were found in the months of February ( $n = 2$ ), March ( $n = 4$ ), May ( $n = 1$ ), and June ( $n = 1$ ); one individual captured in February was not molting. Since January–February coincides with the peak of the rainy season, it is possible that molting in this species is confined to the dry season.

*Ectoparasites.*—The following ectoparasites were collected from this species: Siphonaptera (*Adoratopsylla antiquorum* (Rothschild)); Parasitiformes (*Androlaelaps* sp., *Ixodes* sp.); Acariformes (undetermined species).

*Habitat.*—This small, uncommon, terrestrial marsupial was captured exclusively within the gallery forest.

*Remarks.*—All specimens (ca. 10–30 gm) which were prepared as scientific specimens had three dark stripes dorsally. However, two larger males that lacked the dorsal stripes were captured and released on the mark-recapture grid. Pelage variation in this species needs further study. Paula (1983) caught this species only in the gallery forest of the National Park of Brasília.

### *Monodelphis domestica* (Wagner)

1842. *Didelphys domestica* Wagner, Arch. Naturgesch., 8:359.

*Specimens examined* (2).—GOIÁS: approx. 7 km SE Cristalina, 1 (OMNH). MATO GROSSO DO SUL: Fazenda Nhumirim, 150 km SE Corumbá, 1 (OMNH).

*Measurements.*—See Table 2.

*Reproduction.*—The adult female collected in Goiás was neither pregnant nor lactating. No data are available for a second female collected in Mato Grosso do Sul.

*Molt.*—The entire dorsum of the specimen collected on 7 May at Cristalina showed signs of molt, while molting was evident only on the midline of the venter. No data are available for the specimen collected in Mato Grosso do Sul.

*Ectoparasites.*—The following ectoparasites were collected from this species: Parasitiformes (*Androlaelaps* near *hirsutis* Furman, *Androlaelaps* sp.).

*Habitat.*—The specimen from Cristalina, Goiás, 90 km S Brasília, was collected in campo rupestre, but probably occurs in similar rocky outcrop areas near Brasília. Mares et al. (1981) and Streilen (1982*d*) reported that *M. domestica* preferred rocky habitats in the caatinga.

*Remarks.*—Fonseca and Redford (1984) reported this species in cerrado habitat, while Streilein (1982*a*, 1982*c*, 1982*d*, 1982*e*, 1982*f*) provides detailed information on behavior and ecology in the caatinga. In Formosa, Goiás, this species was also captured (Mello, 1980; Mello and Moojen, 1979). A single individual was captured during an ecological study in Minas Gerais (Dietz, 1983). Alho et al. (1987) and Lacher et al. (1986) captured this species four times in Mato Grosso do Sul.

### *Monodelphis kunsii* Pine

1975. *Monodelphis kunsii* Pine, Mammalia, 39:321.

*Specimens examined* (2).—FEDERAL DISTRICT: 20 km S Brasília, 1 (OMNH), 1 (UNB).

*Measurements.*—See Table 2.

*Reproduction.*—The two adult male specimens, collected in March and August, had scrotal testes. Testes length for the male collected in August was 6 mm.

*Molt.*—The male collected on 25 August was molting on the nose, behind the eyes and in several areas on the mid-dorsum; no data are available for the second male, which was found dead on a road.

*Habitat.*—Both specimens were collected from areas of dense cerrado habitat.

*Remarks.*—The only other known specimens of this species are two individuals taken from northern and southern Bolivia (Anderson, 1982). This report thus extends the range of this apparently uncommon species by about 2100 km.

***Philander opossum* (Linnaeus)**

1758. *Didelphis opossum* Linnaeus, Syst. Nat., 10th ed., 1:55.

*Specimens examined* (2).—MATO GROSSO: 108 km S Poconé, IBDF, 1 (OMNH), 1 (UNB).

*Measurements.*—See Table 2.

*Reproduction.*—No data are available for the female; the male testes measured 14 mm in length.

*Molt.*—The animals, which were collected on 3 and 4 September, were molting in patches on the dorsum.

*Habitat.*—Both specimens were collected on successive nights in Tomahawk live traps placed in an inundated post-harvest corn field.

*Remarks.*—Alho (1981a) found this species common at FAL. Paula (1983) found *Philander* common in swampy areas of gallery forest in the National Park. Mello and Moojen (1979) reported that *Philander* was captured in gallery forest in the Federal District, Mato Grosso and at several sites in Goiás.

Order Chiroptera  
Family Phyllostomidae  
Subfamily Phyllostominae

***Mimon crenulatum* (E. Geoffroy St.-Hilaire)**

1810. *Phyllostoma crenulatum* E. Geoffroy St.-Hilaire, Ann. Mus. Paris, 15:193, plate 10.

*Specimens examined* (2).—MINAS GERAIS: Ilhas das Marias, Tres Marias, 1 (OMNH), 1 (UNB).

*Measurements.*—See Table 3.

*Reproduction.*—Both females, collected in mid-October, were pregnant with one embryo each (CRL = 30, 35 mm). Nipples were small.

*Molt.*—Neither individual showed signs of molt.

*Habitat.*—Both individuals were collected from a group found roosting in a hollow stump about 1.5 m in height along the edge of the reservoir.

*Remarks.*—Pine et al. (1970) reported collecting this species in Mato Grosso.

Subfamily Glossophaginae

***Anoura caudifer* (E. Geoffroy St.-Hilaire)**

1818. *Glossophaga caudifer* E. Geoffroy St.-Hilaire, Mem. Mus. Hist. Nat. Paris, 4:418, plate 17.

*Specimens examined* (7).—FEDERAL DISTRICT: 20 km S Brasília, 3 (OMNH), 1 (UNB); 40 km N Brasília, 3 (UNB).

*Measurements.*—See Table 3.

*Reproduction.*—Two males collected in March had scrotal testes (mean length = 3.5 mm); no data are available for the male collected in February. Four females

Table 3.—External, cranial and dental measurements (in millimeters) of bat species. See the introduction to the Accounts of Species for an explanation of the abbreviations. The mean and observed range are given for each measurement.

	ToL	TL	HF	E	FL	WT	GSL
<i>Mimon crenulatum</i>							
Adult females, 2	79.5 (78-81)	22.0	9.0 (7-11)	29.0	48.0 (46-50)	21.5 (21.0-22.0)	
<i>Anoura caudifer</i>							
Adult males, 3	60.7 (60-62)	0	11.0 (10-12)	13.7 (13-14)	38.0 (37-39)	11.3 (10.4-12.0)	22.7 (22.2-23.1)
Adult females, 4	59.3 (55-62)	0	9.5 (8-10)	12.8 (9-14)	37.3 (36-38)	12.5 (12.0-13.5)	22.9 (22.7-23.3)
<i>Glossophaga soricina</i>							
Adult males, 1	58.0	5.0	10.0	12.0	36.0	10.8	20.9
Adult females, 2	52.5 (50-55)	5.0 (3-7)	9.0	11.5 (9-14)	35.5 (35-36)	10.2 (10.0-10.3)	21.4 (21.3-21.4)
<i>Carollia perspicillata</i>							
Adult males, 10	62.2 (56-66)	6.5 (4-9)	12.7 (11-14)	18.6 (14-21)	41.8 (40-44)	17.0 (12.8-19.0)	22.7 (21.9-23.2)
Adult females, 10	65.6 (55-75)	7.5 (5-11)	13.2 (10-17)	18.2 (13-22)	42.6 (41-45)	17.8 (16.0-20.0)	22.4 (21.4-23.2)
<i>Artibeus cinereus</i>							
Adult males, 2	52.5 (50-55)	0	11.5 (11-12)	15.5 (13-18)	42.0 (41-43)	13.5 (13.0-14.0)	20.6 (19.9-21.3)
Adult females, 2	53.5 (52-55)	0	9.0 (8-10)	16.0 (15-17)	38.5 (38-39)	15.1 (14.7-15.5)	20.6 (20.4-20.7)
<i>Artibeus literatus</i>							
Adult males, 15	87.6 (81-95)	0	18.7 (16-21)	23.0 (21-25)	69.9 (65-74)	65.3 (43.5-77.5)	31.5 (28.9-32.3)
Adult females, 13	89.8 (80-95)	0	19.2 (16-21)	23.8 (22-25)	70.6 (67-76)	71.0 (48.5-88.3)	31.8 (30.1-32.8)



Table 3.—Continued.

	BL	BB	IB	MB	ZB	PL	MTRL
<i>Mimon crenulatum</i>							
Adult females, 2							
<i>Anoura caudifer</i>							
Adult males, 3	19.3 (18.6–19.7)	9.1 (8.9–9.2)	4.6 (4.5–4.6)	9.7	9.8 (9.6–9.9)	12.4 (12.0–12.8)	8.1 (8.0–8.3)
Adult females, 4	19.7 (19.2–20.3)	9.0 (8.9–9.1)	4.3 (3.5–4.7)	9.4 (9.2–9.7)	9.5 (9.3–9.7)	12.6 (12.4–13.1)	8.3 (8.0–8.6)
<i>Glossophaga soricina</i>							
Adult males, 1	16.8	8.4	4.6	9.0	9.3	10.8	6.9
Adult females, 2	17.4 (17.3–17.5)	8.6 (8.4–8.7)	4.7 (4.6–4.8)	9.1 (9.0–9.2)	9.2 (9.1–9.2)	11.3 (11.2–11.3)	7.2
<i>Carollia perspicillata</i>							
Adult males, 10	17.4 (17.0–17.8)	9.8 (9.4–10.3)	5.5 (4.7–5.9)	11.2 (11.0–11.3)		9.5 (9.0–10.2)	7.5 (7.2–7.7)
Adult females, 10	17.3 (17.1–17.7)	9.7 (9.5–10.0)	5.6 (5.3–6.0)	11.0 (10.5–11.4)		9.5 (9.1–9.7)	7.5 (7.2–7.9)
<i>Ariteus cinereus</i>							
Adult males, 2	16.0 (15.5–16.4)	9.6 (9.1–10.1)	5.1 (5.0–5.1)	10.6 (10.0–11.1)	11.9	8.6 (8.4–8.8)	6.7
Adult females, 2	16.1 (16.0–16.1)	9.6	5.0 (4.9–5.1)	10.5 (10.4–10.6)	11.7 (11.6–11.8)	8.8 (8.6–8.9)	6.6 (6.4–6.7)
<i>Ariteus lituratus</i>							
Adult males, 15	24.2 (22.4–24.9)	15.0 (13.9–15.9)	6.7 (6.2–7.4)	16.6 (14.8–17.6)	18.8 (16.6–19.7)	14.6 (13.4–15.3)	11.1 (10.7–11.4)
Adult females, 13	24.6 (23.2–25.3)	15.4 (14.3–16.3)	6.9 (6.4–7.2)	17.1 (16.4–17.8)	19.1 (17.3–19.9)	14.8 (14.0–15.6)	11.1 (10.7–11.7)

Table 3.—Continued.

	ToL	TL	HF	E	FL	WT	GSL
<i>Sturnira lilium</i>							
Adult males, 12	62.9 (60–68)	0	13.0 (11–15)	16.8 (14–18)	43.2 (41–44)	22.5 (18.0–26.0)	23.2 (22.3–24.2)
Adult females, 9	61.7 (61–64)	0	12.4 (11–14)	15.2 (10–18)	42.6 (41–45)	23.4 (19.0–30.5)	23.0 (22.7–23.7)
<i>Vampyrops lineatus</i>							
Adult males, 9	64.2 (60–67)	0	12.1 (10–14)	17.2 (15–19)	45.1 (43–46)	23.6 (20.9–26.6)	25.5 (24.9–26.1)
Adult females, 6	65.7 (64–70)	0	11.3 (8–14)	16.8 (15–20)	46.7 (45–48)	24.5 (22.5–28.0)	25.3 (24.9–25.6)
<i>Desmodus rotundus</i>							
Adult males, 4	75.3 (74–76)	0	16.8 (16–19)	18.3 (17–19)	58.3 (57–60)	36.2 (34.0–38.8)	24.9 (23.6–26.2)
Adult females, 2	77.5 (77–78)	0	16.0	19.5 (19–20)	60.0 (57–63)	35.2 (33.3–37.0)	25.2 (25.0–25.3)
<i>Eptesicus brasiliensis</i>							
Adult males, 1	86.0	31.0	9.0	15.0	41.0	9.0	16.0
Adult females, 1	96.0	41.0	9.0	15.0	44.0	11.0	16.2
<i>Myotis nigricans</i>							
Adult females, 1	65.0	34.0	6.0	10.0	33.0	5.4	13.5
<i>Molossus molossus</i>							
Sex unknown, 1							15.7
<i>Nyctinomops laticaudatus</i>							
Adult males, 1	95.0	37.0	7.0	16.0	45.0	11.7	17.5

Table 3.—Continued.

	BL	BB	IB	MB	ZB	PL	MTRL
<i>Sturnira lilium</i>							
Adult males, 12	17.6 (17.0–18.0)	11.2 (10.8–11.8)	6.1 (5.7–6.7)	12.5 (12.1–13.1)	14.1 (13.7–14.6)	9.1 (8.7–9.8)	7.0 (6.7–7.3)
Adult females, 9	17.0 (16.4–17.6)	11.1 (10.7–11.4)	6.1 (5.8–6.4)	12.2 (11.8–12.4)	13.8 (13.2–14.1)	8.9 (8.6–9.4)	6.8 (6.5–7.2)
<i>Vampyrops lineatus</i>							
Adult males, 9	19.6 (19.3–20.1)	11.2 (10.3–11.5)	6.3 (6.1–6.6)	12.3 (12.2–12.5)	14.1 (13.7–14.4)	11.7 (11.0–12.1)	8.8 (8.4–9.2)
Adult females, 6	19.4 (19.1–20.0)	11.5 (11.2–11.8)	6.3 (6.0–6.4)	12.4 (12.2–12.8)	14.2 (14.0–14.4)	11.4 (11.1–11.7)	8.9 (8.8–9.0)
<i>Desmodus rotundus</i>							
Adult males, 4	18.5 (18.0–19.2)	11.7 (11.0–13.0)	5.3 (5.2–5.4)	12.5 (12.2–13.4)	12.4 (12.0–12.6)	9.0 (8.6–9.4)	3.5 (3.4–3.7)
Adult females, 2	18.6 (18.2–18.9)	11.5 (11.2–11.7)	5.7	12.8 (12.4–13.2)	12.6 (12.5–12.7)	9.1	3.5 (3.4–3.5)
<i>Epptesicus brasiliensis</i>							
Adult males, 1	11.7	8.0	3.7	8.4	10.6	7.5	6.0
Adult females, 1	13.3	8.2	3.9	8.5	10.7	7.7	6.0
<i>Myotis nigricans</i>							
Adult females, 1	10.6	6.8	3.4	7.0	8.5	6.8	5.1
<i>Molossus molossus</i>							
Sex unknown, 1	12.3	9.2	3.5	10.3	10.4	5.4	5.8
<i>Nyctinomops laticaudatus</i>							
Adult males, 1	14.5	9.5	3.9	10.1	10.8	6.9	6.7

were collected in February. One was pregnant with one embryo (CRL = 20 mm) and had well-developed mammary glands.

*Molt.*—None of the individuals showed signs of molt.

*Habitat.*—These bats were netted in campos and cerrados in association with flowering *Caryocar brasiliensis*, in gallery forests (over a stream), and in orchards.

*Remarks.*—Glass and Encarnação (1982) reported specimens from western Minas Gerais. Coimbra et al. (1982) found this species in forest and grassland habitats in Goiás.

### *Glossophaga soricina* (Pallas)

1766. *Vespertilio soricinus* Pallas, Misc. Zool., p. 48, plates 4, 5.

*Specimens examined* (3).—FEDERAL DISTRICT: 25 km S Brasília, 2 (OMNH); 40 km N Brasília, 1 (UNB).

*Measurements.*—See Table 3.

*Reproduction.*—The single adult male, captured in May, had scrotal testes (length = 2 mm). One adult female, collected in early February, was not pregnant or lactating. No information was recorded for a second adult female collected in late February.

*Molt.*—None of the individuals showed signs of molt.

*Habitat.*—Both females were netted near mango trees in an orchard. The male was netted in an open grassy area near a house.

*Remarks.*—Specimens have been captured in Mato Grosso (Pine et al., 1970; Schaller, 1983) and in western Minas Gerais (Glass and Encarnação, 1982).

### Subfamily Carolliinae

### *Carollia perspicillata* (Linnaeus)

1758. *Vespertilio perspicillata* Linnaeus, Syst. Nat., 1:31.

*Specimens examined* (20).—FEDERAL DISTRICT: 20 km S Brasília, 6 (OMNH), 8 (UNB); 25 km S Brasília, 1 (OMNH); 40 km N Brasília, 2 (OMNH). MATO GROSSO: 100 km S Poconé, 1 (OMNH), 2 (UNB).

*Measurements.*—See Table 3.

*Reproduction.*—Six adult males were captured in January. No data are available for three of them, but three had testes lengths of 3, 3, and 4 mm. One collected in February had inguinal testes (length = 3 mm); a second had a testis length of 4 mm. No data are available for a male collected in March. The male captured in April had inguinal testes (length = 3 mm). Females were collected in January ( $n = 2$ ), February ( $n = 3$ ), March ( $n = 2$ ) and September ( $n = 3$ ). One lactating female was captured in January and a second in March. A pregnant female captured in February had one embryo (CRL = 11 mm).

*Molt.*—A female captured in January was molting on the head and right side of the dorsum. A female collected in February was also molting on the head and mid-dorsal region.

*Habitat.*—Three specimens of *Carollia* were found roosting under an old wooden bridge on the Transpantaneira Highway (Mato Grosso). In the Federal District, *Carollia* were netted almost exclusively over streams within gallery forests. In February three specimens were netted in an orchard.

*Remarks.*—The species was also captured in Mato Grosso by Pine et al. (1970) and Schaller (1983). Glass and Encarnação (1982) collected specimens in western Minas Gerais. Coimbra et al. (1982) collected specimens in gallery forest and grasslands in Goiás and at FAL.

## Subfamily Stenoderminae

*Artibeus cinereus* (Gervais)

1856. *Dermanura cinerea* Gervais, Exped. Castelnau Zool., p. 36, plate 7, figs. 4, 4a, 11, 3.

*Specimens examined* (4).—FEDERAL DISTRICT: 20 km S Brasília, 2 (OMNH), 1 (UNB); 40 km N Brasília, 1 (UNB).

*Measurements*.—See Table 3.

*Reproduction*.—Reproductive information was not available for a male collected in January. A second male, collected in May, had inguinal testes (length = 2 mm). The two females collected in February were not pregnant or lactating.

*Molt*.—No individual showed signs of molt.

*Habitat*.—Specimens were netted in gallery forest and orchards.

*Remarks*.—Pine et al. (1970) collected this species in Mato Grosso.

*Artibeus literatus* (Olfers)

1818. *Phyllostomus lituratus* Olfers, in Eschwege, Neue Bibl. Reisenb., p. 224.

*Specimens examined* (28).—FEDERAL DISTRICT: 20 km S Brasília, 14 (OMNH), 13 (UNB); 40 km N Brasília, 1 (UNB).

*Measurements*.—See Table 3.

*Reproduction*.—Males collected in February had testes with a mean length of 5.7 mm ( $n = 3$ ). Of seven males collected in March, one had scrotal testes (length = 9 mm), five had inguinal testes (mean length = 4.7 mm); reproductive information was not available for one. In April, one male had scrotal testes (length = 8 mm) and three had inguinal testes (mean length = 5 mm). A male collected in May had inguinal testes (length = 4 mm). Females were collected in February ( $n = 3$ ), March ( $n = 5$ ), April ( $n = 3$ ) and May ( $n = 2$ ). One female collected in February was pregnant and lactating (one embryo, CRL = 45 mm), one was lactating, and one was not pregnant or lactating. No female collected in March was pregnant or lactating. Two females collected in April were neither lactating nor pregnant; one was pregnant (one embryo, CRL = 3 mm) and had large, well-developed mammae. One female collected in May also had large, well-developed mammae; a second did not.

*Molt*.—One female captured in March was molting on the head and the posterior one-half of the venter.

*Habitat*.—Specimens collected in February, March and April were netted in orchards (especially near goiabas with fruit). Specimens collected in March, April and May were netted over a stream in the gallery forest.

*Remarks*.—This species has also been reported from Mato Grosso (Pine et al., 1970; Schaller, 1983) and western Minas Gerais (Glass and Encarnação, 1982). Coimbra et al. (1982) reported this species in the forest at FAL.

*Sturnira lilium* (E. Geoffroy St.-Hilaire)

1810. *Phyllostoma lilium* E. Geoffroy St.-Hilaire, Ann. Mus. Hist. Nat. Paris, 15:181–182.

*Specimens examined* (21).—FEDERAL DISTRICT: 20 km S Brasília, 5 (OMNH), 6 (UNB); 25 km S Brasília, 1 (UNB); 40 km N Brasília, 4 (OMNH), 5 (UNB).

*Measurements*.—See Table 3.

*Reproduction*.—A male collected in January had scrotal testes (length = 6 mm). Males collected in February ( $n = 4$ ) and April ( $n = 1$ ) had inguinal testes (mean

length = 3.5 mm); no data are available for additional specimens collected in January ( $n = 1$ ), February ( $n = 3$ ), March ( $n = 1$ ) and April ( $n = 1$ ). Females collected in January ( $n = 2$ ) and February ( $n = 2$ ) were lactating. Other females collected in January ( $n = 1$ ), February ( $n = 2$ ) and March ( $n = 1$ ) showed no signs of lactation and were not pregnant. One female, collected in March, was pregnant; the single embryo was large (CRL = 42 mm) and well developed.

*Molt.*—None of the individuals showed signs of molt.

*Habitat.*—Specimens were netted in January ( $n = 4$ ), February ( $n = 7$ ), March ( $n = 1$ ) and April ( $n = 2$ ) over streams in gallery forests. Specimens ( $n = 5$ ) were also netted in an orchard next to the gallery forest in February and in a grassy area next to a house in March ( $n = 1$ ).

*Remarks.*—Specimens were collected by Pine et al. (1970) and Schaller (1983) in Mato Grosso and by Glass and Encarnação (1982) in western Minas Gerais. Coimbra et al. (1982) reported this species from gallery forest in Goiás and at FAL.

### *Vampyrops lineatus* (E. Geoffroy St.-Hilaire)

1810. *Phyllostoma lineatum* E. Geoffroy St.-Hilaire, Ann. Mus. Hist. Nat. Paris, 15:180.

*Specimens examined* (16).—FEDERAL DISTRICT: 20 km S Brasília, 1 (OMNH), 6 (UNB); 25 km S Brasília, 4 (OMNH), 1 (UNB); 40 km N Brasília, 3 (OMNH), 1 (UNB).

*Measurements.*—See Table 3.

*Reproduction.*—Three males collected in February had well-developed testes (mean length = 3.7 mm); no data are available for a fourth male collected during this month or for five males collected in January. Females were collected in January ( $n = 1$ ), February ( $n = 2$ ), March ( $n = 1$ ), May ( $n = 1$ ) and December ( $n = 1$ ). One of two females taken in February was pregnant with one embryo (CRL = 27 mm); both had large, well-developed mammary glands. No data are available for the female collected in December and the one collected in January and for one specimen for which the sex was not known.

*Molt.*—None of the individuals showed signs of molt.

*Habitat.*—This species was netted almost exclusively in orchards, especially in association with mangos. Four specimens were netted over streams in gallery forests.

*Remarks.*—Specimens have been reported from Mato Grosso (Pine et al., 1970) and western Minas Gerais (Glass and Encarnação, 1982). Sazima and Sazima (1975) studied the foraging behavior of this species on *Lafoensia pacari* in Minas Gerais. Coimbra et al. (1982) reported this species in grasslands in Goiás.

### Subfamily Desmodontinae

### *Desmodus rotundus* (E. Geoffroy St.-Hilaire)

1810. *Phyllostoma rotundum* E. Geoffroy St.-Hilaire, Ann. Mus. Hist. Nat. Paris, 15:181.

*Specimens examined* (6).—FEDERAL DISTRICT: 20 km S Brasília, 3 (OMNH), 3 (UNB).

*Measurements.*—See Table 3.

*Reproduction.*—Two males captured in February had scrotal testes (mean length = 5 mm); data for a third male are not available. A male collected in April had inguinal testes (length = 3 mm). The two females collected in February and March were not pregnant or lactating.

*Molt.*—None of the individuals showed signs of molt.

*Habitat*.—Specimens were collected in orchards ( $n = 4$ ) and over a stream in the gallery forest ( $n = 2$ ).

*Remarks*.—Glass and Encarna  o (1982) reported this species from western Minas Gerais. Coimbra et al. (1982) found this species to occur in many habitats in Goi  s and the Federal District.

Family Vespertilionidae  
Subfamily Vespertilioninae

*Eptesicus brasiliensis* (Desmarest)

1819. *Vespertilio brasiliensis* Desmarest, Nouv. Dict. Hist. Nat. Paris, 2nd ed., 35:478.

*Specimens examined* (2).—FEDERAL DISTRICT: 20 km S Bras  lia, 1 (OMNH), 1 (UNB).

*Measurements*.—See Table 3.

*Reproduction*.—The male, captured in April, had inguinal testes (length = 6 mm). The female was captured in January; no embryos were present and the animal was not lactating.

*Molt*.—Neither individual showed signs of molt.

*Habitat*.—Both specimens were netted over a small stream in the gallery forest.

*Myotis nigricans* (Schinz)

1821. *Vespertilio nigricans* Schinz, Thierreich, 1:179.

*Specimen examined* (1).—FEDERAL DISTRICT: 20 km S Bras  lia, 1 (OMNH).

*Measurements*.—See Table 3.

*Reproduction*.—Captured in February, this individual was not pregnant or lactating.

*Molt*.—The single individual showed no sign of molt.

*Habitat*.—This specimen was netted in an orchard.

*Remarks*.—Glass and Encarna  o (1982) captured in western Minas Gerais, while Schaller (1983) reported specimens from Mato Grosso.

Family Molossidae

*Molossus molossus* (Pallas)

1766. *V. (espertilio) molossus* Pallas, Misc. Zool., p. 45–50.

*Specimens examined* (1).—FEDERAL DISTRICT: Federal District, 1 (OMNH).

*Measurements*.—See Table 3.

*Remarks*.—No data on reproductive condition, molt and habitat are available for this specimen. Pine et al. (1970) and Schaller (1983) collected this species in Mato Grosso.

*Nyctinomops laticaudatus* (E. Geoffroy St.-Hilaire)

1805. *Molossus laticaudatus* E. Geoffroy St.-Hilaire, Ann. Mus. Hist. Nat. Paris, 6:156.

*Specimen examined* (1).—FEDERAL DISTRICT: 20 km S Bras  lia, 1 (OMNH).

*Measurements*.—See Table 3.

*Reproduction*.—The single specimen, collected in April, was not pregnant or lactating.

*Molt*.—There was no evidence of molt.

*Habitat.*—The specimen was netted in the cerrado next to flowering *Caryocar brasiliensis*.

Order Primates  
Family Cebidae  
Subfamily Cebinae

*Cebus apella* (Linnaeus)

1758. *Simia apella* Linnaeus, Syst. Nat., 10th ed., 1:28.

*Remarks.*—Fonseca and Redford (1984) reported that this species has not been observed on the IBGE Reserve for a number of years although they have been located in nearby gallery forests. This species was commonly observed in the gallery forests of both FAL and IBGE during our study. Also, several previously captive individuals were released on the reserve by IBGE personnel during our study. Schaller (1983) studied this species in Mato Grosso.

Subfamily Alouattinae  
*Alouatta caraya* (Humboldt)

1812. *Simia caraya* Humboldt, Rec. Observ. Zool., 1:355.

*Remarks.*—This species was observed in the gallery forests of the Federal District (FAL and IBGE) and in forests near the IBDF reserve (Mato Grosso, near Poconé). An adult male was observed in an agricultural area (FAL) surrounded by cerrado (*sensu stricto*) over a kilometer away from the nearest gallery forest. Alho et al. (1987) and Lacher et al. (1986) observed this species only during diurnal censuses in Mato Grosso do Sul, and Schaller (1983) worked intensively with the ecology of this species in the pantanal.

Subfamily Callitrichinae  
*Callithrix jacchus* (Linnaeus)

1758. *Simia jacchus* Linnaeus, Syst. Nat., 10th ed., 1:27.

*Remarks.*—This species was commonly observed in all gallery forest and cerrado habitats of central Brazil. It was also seen in cerrado habitats and three individuals were seen in an isolated *Vochysia* tree in the middle of campo limpo at FAL. Fonseca and Redford (1984) frequently observed this species in the gallery forest. Fonseca and Lacher (1984) found two groups living in the cerrado of IBGE. Foraging activity and diet of the species are discussed by Fonseca and Lacher (1984) and Lacher et al. (1984).

Order Xenarthra  
Family Dasypodidae  
*Cabassous unicinctus* (Linnaeus)

1758. *Dasypus unicinctus* Linnaeus, Syst. Nat., 10th ed., 1:50.

*Ectoparasites.*—A female tungid flea (*Tunga* sp.) was excised from the inguinal region.

*Remarks.*—This highly fossorial armadillo was observed in cerrado habitats of FAL and IBGE. One female was captured by hand as it attempted to cross a road. It was examined for ectoparasites and released. Fonseca and Redford (1984) reported capturing one individual in an open grassy field of the IBGE Reserve.



*Dasybus novemcinctus* Linnaeus

1758. *Dasybus novemcinctus* Linnaeus, Syst. Nat., 10th ed., 1:51.

*Remarks.*—We observed this armadillo in both cerrado and gallery forest. Fonseca and Redford (1984) reported this species in cerrado and cerrado and open areas of IBGE. They also noted that it may place its burrows along gallery forest streams. Schaller (1983) reported this species in the pantanal. Alho et al. (1987) and Lacher et al. (1986) observed *D. novemcinctus* southeast of Corumbá, Mato Grosso do Sul, during both diurnal and nocturnal censuses.

*Dasybus septemcinctus* Linnaeus

1758. *Dasybus septemcinctus* Linnaeus, Syst. Nat., 1758:51.

*Specimen examined* (1).—FEDERAL DISTRICT: 20 km S Brasília, 1 (OMNH).

*Measurements.*—See Table 4.

*Reproduction.*—No data on reproductive condition are available for this specimen (a male).

*Molt.*—No data on molt are available for this specimen.

*Habitat.*—This individual was found dead on a dirt road between a eucalyptus grove and campo sujo.

*Euphractus sexcinctus* (Linnaeus)

1758. *Dasybus sexcinctus* Linnaeus, Syst. Nat., 10th ed., 1:51.

*Remarks.*—Individuals were observed at FAL and IBGE. A specimen was collected in cerrado by Fonseca and Redford (1984) on the IBGE Reserve. This species was observed during diurnal censuses southeast of Corumbá, Mato Grosso do Sul (Alho et al., 1987; Lacher et al., 1986). Schaller (1983) also found it in Mato Grosso.

*Prionomys maximus* (Kerr)

1792. *Dasybus maximus* Kerr, Anim. Kingdom, p. 112.

*Remarks.*—The status of this species at FAL and IBGE is uncertain. Fonseca and Redford (1984) reported fresh burrows in cerrado at IBGE in 1981. An active burrow (>40 cm in both height and width) was observed by DG in cerrado at IBGE in March 1988. Burrows of this species were found by Schaller (1983) in the pantanal.

## Family Myrmecophagidae

*Myrmecophaga tridactyla* Linnaeus

1758. *Myrmecophaga tridactyla* Linnaeus, Syst. Nat., 10th ed., 1:35.

*Remarks.*—Several individuals were seen near Poconé, Mato Grosso. A skull of this species was observed at Tres Marias in 1983. Shaw et al. (1985) reported on the foraging patterns, prey abundance, and population density of giant anteaters in western Minas Gerais. Alho et al. (1987) and Lacher et al. (1986) observed this species southeast of Corumbá, Mato Grosso do Sul, only during diurnal censuses. Schaller (1983) observed a single individual in the pantanal.

***Tamandua tetradactyla* (Linnaeus)**

1758. *Myrmecophaga tetradactyla* Linnaeus, Syst. Nat., 10th ed., 1:35.

*Specimen examined* (1).—MATO GROSSO: 109 km E Cuiaba, 1 (OMNH).

*Measurements*.—See Table 4.

*Reproduction*.—No reproductive data are available for this specimen (a female).

*Molt*.—This specimen was not molting.

*Habitat*.—The specimen was found dead on a road in an agricultural area of the cerrado.

*Remarks*.—A skull was observed at the Estação Ecologica de Pirapitinga, near Tres Marias, Minas Gerais. Fonseca and Redford (1984) reported finding a carcass of this species in cerrado habitat. Alho et al. (1987) and Lacher et al. (1986) observed *T. tetradactyla* southeast of Corumbá, Mato Grosso do Sul, during both diurnal and nocturnal censusing. Schaller (1983) observed this species in the pantanal.

**Order Lagomorpha****Family Leporidae*****Sylvilagus brasiliensis* (Linnaeus)**

1758. *Lepus brasiliensis* Linnaeus, Syst. Nat., 10th ed., 1:58.

*Specimens examined* (3).—FEDERAL DISTRICT: 25 km S Brasília, 2 (OMNH), 1 (UNB).

*Measurements*.—See Table 4.

*Reproduction*.—All three specimens were collected in June. The male had scrotal testes (length = 8 mm). The adult female was pregnant. Two embryos were found in the right uterine horn and one was situated in the left. Mammary development was slight. The subadult female was not pregnant.

*Molt*.—Molting was observed on the mid-dorsum of the adult female but was absent in the male and the subadult female.

*Ectoparasites*.—The following ectoparasites were collected from this species: Siphonaptera (*Polygenis* sp.); Parasitiformes (*Amblyomma* sp.).

*Habitat*.—All three specimens were collected in traps set either along a stream or an irrigation ditch. One was trapped at an interface between disturbed gallery forest and an orchard, one trapped in a disturbed marshy area below an orchard, and the third trapped near the edge of an orchard. Although these rabbits were observed in both upland and lowland habitats, most individuals were observed in or near the gallery forest. This species is common in agricultural areas.

*Remarks*.—Fonseca and Redford (1984) observed individuals in cerrado, cerrado, and campo habitats at IBGE. Schaller (1983) reported this species as rare in the pantanal.

**Order Rodentia****Family Muridae****Subfamily Sigmodontinae*****Akodon cursor* (Winge)**

1887 (1888). *Habrothrix cursor* Winge, E. Mus. Lundii, 1(3):25.

*Specimens examined* (16).—FEDERAL DISTRICT: 20 km S Brasília, 8 (OMNH), 6 (UNB); 20 km SW Brasília, 2 (OMNH).

*Measurements*.—See Table 4.

**Reproduction.**—Adult males with scrotal testes were captured in March ( $n = 1$ ; length = 17 mm), July ( $n = 2$ ; length = 8, 14 mm) and August ( $n = 1$ ; length = 12 mm). Adult males with inguinal testes were collected in May ( $n = 2$ ; length = 6, 7 mm). Subadult males with abdominal testes were captured in March ( $n = 1$ ; length = 4 mm) and May ( $n = 1$ ; length = 2 mm). Adult females were collected in February ( $n = 1$ ), March ( $n = 1$ ), July ( $n = 1$ ) and August ( $n = 1$ ). A pregnant female was collected in August (three embryos, mean CRL = 11 mm) and a lactating female in March. Both females collected in February and July had well-developed mammae. Subadult females were captured in February ( $n = 1$ ), March ( $n = 1$ ), April ( $n = 1$ ) and May ( $n = 1$ ).

**Molt.**—Adult, subadult and juvenile individuals were found molting in February ( $n = 2$ ), March ( $n = 4$ ), April ( $n = 1$ ), May ( $n = 3$ ), July ( $n = 3$ ) and August ( $n = 2$ ). Specimens from other months were not available for examination.

**Ectoparasites.**—The following ectoparasites were collected from this species: Anoplura (*Hoplopleura* sp.); Parasitiformes (*Androlaelaps rotundus* Fonseca, *A. fahrenheitsi* (Berlese)).

**Habitat.**—All specimens were collected in terrestrial traps in the gallery forest, generally in open grassy areas within the forest caused by tree falls.

**Remarks.**—This species occurred exclusively within the gallery forest. Individuals are terrestrial and nocturnal. Most captures (9 of 16) were recorded from the open, grassy areas associated with fallen trees. A similar pattern of habitat selection was reported by Nitikman and Mares (1987). In the field, this species is easily confused with *Bolomys lasiurus*. Mello (1977, 1980) and Mello and Moojen (1979) listed this species as *Zygodontomys lasiurus*; those individuals captured in the gallery forest are probably *A. cursor*. Mello (1980) reported on the population dynamics of this species.

### *Akodon reinhardti* Langguth

1975. *Akodon reinhardti* Langguth, *Pápeis Avulsos de Zool.*, 29:45–54.

*Specimens examined* (6).—FEDERAL DISTRICT: 20 km S Brasília, 3 (OMNH), 3 (UNB).

*Measurements.*—See Table 4.

**Reproduction.**—Adult males were collected in January ( $n = 1$ ; length = 5 mm) and September ( $n = 1$ ; length = 6 mm). A juvenile male was collected in October. Adult females were collected in August, September and October. The female collected in October was pregnant (2 embryos; CRL = 14 mm).

**Molt.**—Three individuals (all adults) were in various stages of molt in January, September and October.

**Ectoparasites.**—The following ectoparasites were collected from this species: Parasitiformes (*Androlaelaps foxi* Fonseca, *A. pachyptilae* (Zumpt and Till), *A. fahrenheitsi* (Berlese)); Acariformes (undetermined species).

**Habitat.**—Three animals were captured in cerrado, two in campo sujo, and one in dry campo limpo.

**Remarks.**—Dietz (1983) captured a number of individuals of what he called *Akodon lasiotis* in cerrado and grassland habitats in Minas Gerais. These specimens may be *Akodon reinhardti*.

### *Akodon* sp. 1

*Specimen examined* (1).—FEDERAL DISTRICT: 25 km S Brasília, 1 (OMNH).

*Measurements.*—See Table 4.

*Reproduction.*—The adult male which was collected in May had inguinal testes (length = 5 mm).

*Molt.*—This specimen was molting both dorsally and ventrally.

*Habitat.*—The specimen was collected in cerrado habitat.

*Remarks.*—Externally this specimen resembles *Akodon reinhardti*, but is much larger (46.5 g vs. 17.6 g for *A. reinhardti*). However, it has the same dark reddish color of *A. reinhardti*. At present, it is unidentified.

### *Akodon* sp. 2

*Specimens examined* (1).—FEDERAL DISTRICT: 20 km S Brasília, 1 (OMNH).

*Measurements.*—See Table 4.

*Reproduction.*—The subadult female, collected in March, was not pregnant or lactating.

*Molt.*—The specimen was molting.

*Habitat.*—The individual was collected in campo sujo near a pond.

### *Bolomys lasiurus* (Lund)

1841. *Mus lasiurus* Lund, Kongl. Dansk. Vid. Selsk. Naturv. Math. Afhandl., 8:50.

*Specimens examined* (147).—FEDERAL DISTRICT: 20 km S Brasília, 70 (OMNH), 54 (UNB), 1 (IBGE); 21 km S Brasília, 1 (OMNH); 25 km S Brasília, 3 (OMNH), 7 (UNB); 20 km SW Brasília, 1 (OMNH), 1 (UNB). MINAS GERAIS: Tres Marias, Ilha das Marias, 3 (OMNH), 6 (UNB).

*Measurements.*—See Table 4 (data from Macêdo and Mares, 1987).

*Reproduction.*—Males with scrotal testes were collected in January ( $n = 7$ ; mean length = 9.1 mm), March ( $n = 4$ ; mean length = 10.8 mm), May ( $n = 3$ ; mean length = 11 mm), August ( $n = 2$ ; mean length = 10 mm), October ( $n = 4$ ; mean length = 13 mm) and November ( $n = 1$ ; length = 10 mm). Males with inguinal testes were collected in January ( $n = 1$ ; no measurement), February ( $n = 1$ ; length = 10 mm), April ( $n = 11$ ; mean length = 8.2 mm), May ( $n = 10$ ; mean length = 7.1 mm), July ( $n = 5$ ; mean length = 6.4 mm) and October ( $n = 3$ ; length = 3.5 mm). Males (juveniles) with abdominal testes were collected in January ( $n = 2$ ; mean length = 5 mm), March ( $n = 4$ ; length = 5 mm) and April ( $n = 8$ ; mean length = 5 mm). Adult males for which limited data are available were collected in April ( $n = 1$ ), August ( $n = 5$ ), September ( $n = 1$ ) and October ( $n = 6$ ). Additional subadults and juveniles were collected in March ( $n = 1$ ), June ( $n = 1$ ), September ( $n = 1$ ) and October ( $n = 1$ ). Pregnant females were collected in January ( $n = 2$ ; number of embryos, respectively = 5, 5; mean CRL, respectively = 9, 15 mm), March ( $n = 5$ ; number of embryos, respectively = 5, 4, 7, 5, 3; mean CRL, respectively = 27, 12, 26, 34, 18 mm) and October ( $n = 4$ ; number of embryos, respectively = 4, 4, 5, 4; mean CRL, respectively = 6, 8, 7, 18 mm). Lactating females were collected in January ( $n = 1$ ), March ( $n = 3$ ) and April ( $n = 2$ ). Females with a vaginal plug were collected in March ( $n = 2$ ) and April ( $n = 2$ ).

*Molt.*—Molting individuals were found in all months except June and December. About the same number of individuals were found not to be molting in these same months.

*Habitat.*—Specimens were caught in the following habitats: campo sujo, dry campo sujo, disturbed campo sujo, wet campo sujo, cerrado, campo limpo, dry campo limpo, wet campo limpo, dry campo limpo/sujo, wet campo limpo/sujo, brejo, disturbed brejo, brejo and cerrado borders, bracken fern and African grass, and in cerrado-cerradão.

*Ectoparasites*.—The following ectoparasites were collected from this species: Anoplura (*Hoplopleura* sp.); Siphonaptera (*Rhopalopsylla* sp., *Polygenis* sp.); Parasitiformes (*Androlaelaps foxi* Fonseca, *A. fahrenheitsi* (Berlese), *A. rotundus* (Fonseca), *Amblyomma* sp.); Acariformes (undetermined species).

*Remarks*.—Fonseca and Redford (1984) reported collecting one specimen from cerrado bordering gallery forest on the IBGE Reserve. Alho (1981a), Borchert and Hansen (1983), Mello (1977, 1980), and Mello and Moojen (1979) listed this species as *Zygodontomys lasiurus*; individuals captured in cerradão, cerrado and campo are probably *B. lasiurus*. Individuals captured in gallery forest may be *Akodon cursor*. Paula (1983) found this species in the campo cerrado during all seasons and in the wet campo during the dry season. Pine et al. (1970) and Schaller (1983) captured this species in Mato Grosso. Density, home range, and space utilization for this species was reported by Alho and Souza (1982) and Souza and Alho (1980). Mello (1980) and Valle et al. (1982) studied the population dynamics of this species in Goiás and Minas Gerais, respectively. Microhabitat preference, food habits, activity, and population changes due to fire and flood were studied by Borchert and Hansen (1983). Dietz (1983) found this species restricted to grasslands and cerrado in Minas Gerais.

### *Calomys callosus* (Rengger)

1830. *Mus callosus* Rengger, Naturg. Saug. von Paraguay, Basle, p. 231.

*Specimens examined* (39).—FEDERAL DISTRICT: 20 km S Brasília, 3 (OMNH), 2 (UNB), 1 (IBGE); 21 km S Brasília, 2 (UNB). MATO GROSSO: 105 km S Poconé, 1 (UNB); 108 km S Poconé, 5 (OMNH), 4 (UNB); 115 km S Poconé, 5 (OMNH), 5 (UNB). MINAS GERAIS: Tres Marias, Ilha das Marias, 3 (OMNH), 8 (UNB).

*Measurements*.—See Table 4.

*Reproduction*.—Males were caught in both September and October. Mean testis length for males trapped in September is 11.8 mm ( $n = 13$ ). Mean testis length for males trapped in October is 10.1 mm ( $n = 8$ ). Data are not available for five males trapped in September. Pregnant females were caught in both September ( $n = 7$ ) and October ( $n = 1$ ). Number of embryos and mean CRL, respectively, are: 6, 6 mm; 6, 3 mm; 7, 8 mm; 3, 1 mm; 7, 6 mm; 6, 9 mm; 5, 6 mm; 3, 4 mm. Non-pregnant females were caught in September ( $n = 1$ ) and October ( $n = 3$ ). The sex of one individual was not determined.

*Molt*.—Individuals were found molting in both September ( $n = 15$ ) and October ( $n = 4$ ); non-molting individuals were also captured in September ( $n = 8$ ) and October ( $n = 7$ ). No data are available for one individual collected in March, three collected in September and one collected in October.

*Ectoparasites*.—The following ectoparasites were collected from this species: Parasitiformes (*Laelaps mazzai* Fonseca); Acariformes (undetermined species).

*Habitat*.—Individuals of this species were captured in cerrado, cerradão, gallery forest margins, brejo, and borders between cerrado/campo sujo and brejo in the Federal District. At Tres Marias, Minas Gerais, specimens were collected in campo sujo, cerrado, dry gallery forest, and margins between the lake and the dry gallery forest. In Mato Grosso, specimens were caught in buildings, disturbed areas along roads, margins between dry forest and ponds, and margins between grassland and marsh.

*Remarks*.—Alho (1981a) found *Calomys* in cerrado, cerradão, campo, and gallery forest habitats at FAL. In the Federal District and Goiás, this species was

captured in gallery forest, cerradão, cerrado and campo (Mello, 1977; Mello and Moojen, 1979). Mello (1980) and Valle et al. (1982) studied the population dynamics of this species in Goiás and Minas Gerais, respectively. A few captures of this species in Mato Grosso do Sul were reported by Alho et al. (1987) and Lacher et al. (1986). Schaller (1983) reported this species in the pantanal.

### *Calomys tener* (Winge)

1888. *Hesperomys tener* Winge, E. Mus. Lundii, 1(3):15, plate 2, figure 3.

*Specimens examined* (35).—FEDERAL DISTRICT: 20 km S Brasília, 12 (OMNH), 7 (UNB). MINAS GERAIS: Tres Marias, Ilha das Marias, 8 (OMNH), 8 (UNB).

*Measurements*.—See Table 4.

*Reproduction*.—Males were collected in April ( $n = 1$ ; length = 7 mm), May ( $n = 1$ ; length = 4 mm), August ( $n = 1$ ; length = 7 mm), September ( $n = 3$ ; mean length = 7 mm), October ( $n = 15$ ; mean length = 7.3 mm) and November ( $n = 1$ ; no measurement). Pregnant females were collected in October ( $n = 3$ ; number of embryos, respectively = 4, 4, 3; mean CRL, respectively = 15, 8, 4 mm). A fourth pregnant female was also taken in October but no additional data are available. A lactating female with a vaginal plug was collected in January and a female with a vaginal plug was captured in August. Additional females were collected in January ( $n = 1$ ), September ( $n = 1$ ) and October ( $n = 5$ ).

*Molt*.—Individuals were found molting in January ( $n = 1$ ), April ( $n = 1$ ), May ( $n = 1$ ), August ( $n = 1$ ) and October ( $n = 6$ ). Non-molting animals were collected in January ( $n = 1$ ), August ( $n = 1$ ), September ( $n = 3$ ) and October ( $n = 4$ ). No data are available for the remainder of the specimens.

*Ectoparasites*.—The following ectoparasites were collected from this species: Parasitiformes (*Laelaps mazzai* Fonseca).

*Habitat*.—Individuals were collected in the following habitats: cerrado, campo sujo, cerradão, brejo, campo sujo/cerrado, borders of grassy shores of lakes, and in both gallery forest and campo limpo.

*Remarks*.—Alho (1981a) found *Calomys* in cerrado, cerradão, campo and gallery forest habitats at FAL. In the Federal District and Goiás, this species was captured in gallery forest, cerradão, cerrado, and campo (Mello, 1977; Mello and Moojen, 1979). Mello (1980) studied the population dynamics of this species in Goiás. Dietz (1983) found this species restricted to grassland and cerrado habitat in Minas Gerais.

### *Holochilus brasiliensis* (Desmarest)

1819. *Mus brasiliensis* Desmarest, Nouv. Dict. Hist. Nat. Paris, 2nd. ed., 29:62.

*Specimens examined* (5).—MATO GROSSO: 105 km S Poconé, Fazenda Boa Vista, 1 (OMNH); 108 km S Poconé, IBDF, Base de Pesquisas, 1 (OMNH), 1 (UNB); 115 km S Poconé, IBDF, 1 (OMNH), 1 (UNB).

*Measurements*.—See Table 4.

*Reproduction*.—All specimens were collected in early September. Two adult males had testes lengths of 16 and 17 mm and a subadult male had testes 8 mm in length. The adult female was neither pregnant nor lactating. No data are available for the subadult female.

*Molt*.—None of the adult animals were molting. The two subadults were in various stages of molt.

*Ectoparasites*.—The following ectoparasites were collected from this species:

Parasitiformes (*Gigantolaelaps mattogrossensis* (Fonseca), *Laelaps* sp.); Acari-formes (undetermined species).

*Habitat*.—Specimens were captured in a grassy marsh, a marshy cornfield, along the margin of a grassy pond, or in a disturbed agricultural area. Specimens were caught in both Sherman and Tomahawk traps.

*Remarks*.—In the Federal District, Goiás and Mato Grosso, Mello and Moojen (1979) found this species in gallery forest. This species was captured in forest along streams near Formosa, Goiás (Mello, 1977, 1980).

### *Nectomys squamipes* (Brants)

1827. *Mus squamipes* Brants, Het. Gesl. Muiz., p. 138.

*Specimens examined* (30).—FEDERAL DISTRICT: 15 km S, 2.5 km W Brasília, 1 (OMNH); 19 km S Brasília, 2 (OMNH); 20 km S Brasília, 2 (OMNH), 5 (UNB); 25 km S Brasília, 3 (OMNH), 1 (UNB); 20 km SW Brasília, 5 (OMNH), 3 (UNB); 15 km S, 25 km W Brasília, 1 (OMNH), 4 (UNB). GOIÁS: 12 km NE Cristalina, Faz. Nova India, 1 (OMNH); 12 km NE Cristalina, 2 (UNB).

*Measurements*.—See Table 4.

*Reproduction*.—Males with inguinal testes were collected in April ( $n = 2$ ; mean length = 15 mm), May ( $n = 2$ ; mean length = 12.5 mm), June ( $n = 1$ ; length = 20 mm), August ( $n = 1$ ; length = 17 mm) and December (a subadult). Males with scrotal testes were captured in April ( $n = 1$ ; length = 17 mm), May ( $n = 2$ ; mean length = 13 mm), July ( $n = 2$ ; mean length = 17.5 mm), August ( $n = 4$ ; mean length = 18.25 mm), October ( $n = 1$ ; length = 17 mm) and November (no measurement). An adult male captured in January had testes 16 mm long, but testis position was not noted. Pregnant females were captured in May ( $n = 1$ ), August ( $n = 2$ ), October ( $n = 1$ ) and November ( $n = 1$ ). Number of embryos varied from three to five. Crown-rump length varied from 6 mm (August) to 25 mm (October). All pregnant females had well-developed mammae. The pregnant female collected in early November and kept in captivity gave birth to three young (two males and one female) on 16 November. No information is available for a female collected in May. A subadult female was collected in both October and November.

*Molt*.—Molting individuals were captured in January ( $n = 1$ ), April ( $n = 3$ ), May ( $n = 4$ ), June ( $n = 1$ ), July ( $n = 1$ ), August ( $n = 6$ ), October ( $n = 3$ ), November ( $n = 1$ ) and December ( $n = 1$ ). Non-molting individuals were taken in May ( $n = 2$ ), July ( $n = 1$ ), August ( $n = 1$ ) and November ( $n = 5$ ).

*Ectoparasites*.—The following ectoparasites were collected from this species: Anoplura (*Hoplopleura quadridentata* (Neumann)); Siphonaptera (*Polygenis* sp.); Parasitiformes (*Gigantolaelaps goyanensis* Fonseca, *Laelaps manguinhosa* Fonseca, *Androlaelaps fahrenheitsi* (Berlese), *Amblyomma* sp.); Acariformes (undetermined species).

*Habitat*.—All but three specimens were collected along streams in the gallery forest. Two of the animals collected at Cristalina were trapped along a brejo stream 20–30 m from the gallery forest edge. One specimen collected in the Federal District was trapped in a disturbed area with bracken ferns and African grass 80–100 m from a gallery forest stream. All specimens but two were collected in Tomahawk traps.

*Remarks*.—Fonseca and Redford (1984) always found this species in close association with water on the IBGE Reserve. Ernest and Mares (1986) found that *N. squamipes* was a seasonal breeder, since pregnant animals were noted only in the early part of the wet season. Additionally, only 2% of their captures occurred

in dry areas more than 10 m from a stream edge. They noted that this species clearly prefers streams in dense forest where large trees are found. In the National Park of Brasília, Paula (1983) found this species to be common in the gallery forest. This species has also been captured in Mato Grosso (Pine et al., 1970). Mello (1977, 1980) and Mello and Moojen (1979) reported that in the Federal District, Goiás and Mato Grosso, this species prefers the gallery forest. Two individuals were captured during an ecological study in Minas Gerais (Dietz, 1983). Ernest (1986) reviewed the biology of this species.

***Oryzomys bicolor* (Tomes)**

1860. *Hesperomys bicolor* Tomes, Proc. Zool. Soc. London, 1860:217.

*Specimens examined* (24).—FEDERAL DISTRICT: 20 km S Brasília, 8 (OMNH), 6 (UNB), 1 (IBGE); 21 km S Brasília, 1 (UNB); 25 km S Brasília, 2 (OMNH), 3 (UNB); 20 km SW Brasília, 2 (OMNH), 1 (UNB).

*Measurements*.—See Table 4.

*Reproduction*.—Both males collected in February had scrotal testes (mean length = 9.5 mm). A male collected in March had scrotal testes (length = 8 mm); a juvenile male had abdominal testes (length = 3 mm). Of three males collected in May, two had scrotal testes (length = 6, 10 mm) and one had inguinal testes (length = 8 mm). Both males collected in July had scrotal testes (mean length = 8 mm). A juvenile male collected in October had abdominal testes (length = 6 mm); both adult males had scrotal testes (mean length = 8 mm). A male collected in November had scrotal testes (length = 8.5 mm). Adult females were collected in February ( $n = 2$ ), May ( $n = 3$ ), August ( $n = 1$ ), September ( $n = 1$ ) and November ( $n = 1$ ). All females had closed vaginas. Pregnant females were collected in February ( $n = 1$ ; two embryos, CRL = 13 mm), August ( $n = 1$ ; three embryos, CRL = 15 mm), September ( $n = 1$ ; five embryos, CRL = 10 mm) and November ( $n = 1$ ; three embryos, CRL = 6 mm). Subadult and juvenile females were captured in March ( $n = 2$ ) and May ( $n = 1$ ).

*Molt*.—Specimens taken in October ( $n = 3$ ) and November ( $n = 2$ ) were in full dorso-ventral molt. Some specimens taken in February ( $n = 3$ ), March ( $n = 1$ ), May ( $n = 2$ ), July ( $n = 2$ ), and August ( $n = 1$ ) were in various stages of molt. Specimens not molting were taken in February ( $n = 1$ ), March ( $n = 3$ ), May ( $n = 5$ ) and September ( $n = 1$ ).

*Ectoparasites*.—The following ectoparasites were collected from this species: Parasitiformes (*Ixodes* sp., *Gigantolaelaps amazonae* Furman, *Laelaps acuminata* Furman, *L. spicata* Furman, *Argitis oryzomys*); Acariformes (undetermined species).

*Habitat*.—All specimens were collected in arboreal Sherman traps set in gallery forest.

*Remarks*.—Nitikman and Mares (1987) found this species in various gallery forest microhabitats. Pine et al. (1970) collected this species in Mato Grosso.

***Oryzomys capito* (Olfers)**

1818. *Mus capito* Olfers, in Eschwege, Neue Bibl. Reisenb., 15:209.

*Specimens examined* (32).—FEDERAL DISTRICT: 20 km S Brasília, 11 (OMNH), 9 (UNB), 1 (IBGE); 21 km S Brasília, 1 (OMNH); 25 km S Brasília, 4 (OMNH), 4 (UNB); 20 km SW Brasília, 2 (OMNH).

*Measurements*.—See Table 4.



**Reproduction.**—Adult males were collected in February, March, April, May, September and October. Males with inguinal testes were collected in February ( $n = 1$ ; length = 8 mm), March ( $n = 3$ ; mean length = 7.7 mm), April ( $n = 3$ ; mean length = 7.7 mm) and May ( $n = 1$ ; length = 8 mm). Males with scrotal testes were collected in April ( $n = 3$ ; mean length = 8.5 mm), May ( $n = 1$ ; length = 8 mm), September ( $n = 1$ ; length = 12 mm) and October ( $n = 2$ ; mean length = 10.5 mm). Juvenile and subadult males were collected in March ( $n = 1$ ), April ( $n = 1$ ), May ( $n = 1$ ), June ( $n = 2$ ) and September ( $n = 1$ ). All four juveniles had abdominal testes (mean length = 5.75 mm); two subadults had small scrotal testes (mean length = 7.5 mm). Adult females were collected in February ( $n = 1$ ), March ( $n = 2$ ), April ( $n = 1$ ), July ( $n = 1$ ), October ( $n = 1$ ) and November ( $n = 1$ ). Pregnant females were collected in all of the above months except March and April. Number of embryos varied from three to five; crown-rump lengths of the embryos of individual females averaged, 3, 10, 26 and 35 mm for the months of February, November, July and October, respectively. A nonpregnant but lactating female was collected in March. Pregnant females had open vaginas, whereas nonpregnant females had closed vaginas. Subadult and juvenile females with closed vaginas were collected in January ( $n = 1$ ), March ( $n = 1$ ), September ( $n = 1$ ) and October ( $n = 1$ ).

**Molt.**—At least some individuals were found in full molt in all months except August and December, when no individuals were captured.

**Ectoparasites.**—The following ectoparasites were collected from this species: Anoplura (*Hoplopleura* sp.); Siphonaptera (*Polygenis* sp.); Parasitiformes (*Ixodes* sp., *Gigantolaelaps oudemansi* Fonseca; *Androlaelaps fahrenheitsi* (Berlese)); Acariformes (undetermined species).

**Habitat.**—All specimens, except one, were collected in Sherman traps placed on the ground; all were collected in gallery forests.

**Remarks.**—Nitikman and Mares (1987) found this species to be almost exclusively terrestrial and to prefer dense forest or complex mosaic forest. Pine et al. (1970) captured this species in Mato Grosso.

### *Oryzomys chacoensis* Myers and Carleton

1981. *Oryzomys chacoensis* Myers and Carleton, Misc. Publ. Mus. Zool. Univ. Michigan, 161:19.

*Specimens examined* (1).—MATO GROSSO: 115 km S Poconé, 1 (OMNH).

*Measurements.*—See Table 4.

**Reproduction.**—The adult male, collected in September, had inguinal testes with a length of 12 mm.

**Molt.**—The specimens showed signs of molt on the dorsum with two patches of active hair growth just posterior to the ears and a patch on each hip.

**Habitat.**—The single specimen was collected in aquatic vegetation along the margin of a small pond cut back into the dry gallery forest.

### *Oryzomys concolor* (Wagner)

1845. *Hesperomys concolor* Wagner, Arch. Naturgesch., 11(1):147.

*Specimens examined* (10).—FEDERAL DISTRICT: 20 km S Brasília, 3 (OMNH), 1 (UNB), 1 (IBGE); 25 km S Brasília, 1 (OMNH), 2 (UNB); 20 km SW Brasília, 1 (UNB). MINAS GERAIS: Tres Marias, Ilha das Marias, 1 (OMNH).

*Measurements.*—See Table 4.

Table 4. — External cranial and dental measurements (in millimeters) for xenarthrans, lagomorphs and rodents. See the introduction to the Accounts of Species for an explanation of the abbreviations. The mean and observed range are given for each measurement.

	ToL	TL	HL	E	WT	GSL	BL
<i>Dasyus septemcinctus</i>							
Adult males, 1	286.0	122.0	41.0	25.0	255.0		
<i>Tamandua tetradactyla</i>							
Adult females, 1	985.0	430.0	90.0	52.0			
<i>Sylvilagus brasiliensis</i>							
Adult males, 1	380.0	22.0	87.0	59.0	1000+	76.5	58.2
Adult females, 1	370.0	30.0	88.0	60.0	1000+	74.0	56.9
Subadults, 1 female	290.0	20.0	71.0	51.0	562.0	61.1	47.7
<i>Akodon cursor</i>							
Adult males, 6	215.5 (196–226)	98.2 (91–105)	25.8 (25–27)	19.3 (19–20)	48.6 (34.5–55.9)	29.6 (27.7–30.5)	23.3 (20.9–24.7)
Adult females, 4	205.3 (196–214)	87.5 (82–95)	25.0	18.0 (17–19)	40.0 (31.3–45.5)	29.0 (28.1–29.7)	22.9 (22.0–23.7)
Subadults, 6 (2 males, 4 females)	158.2 (132–181)	72.0 (62–82)	24.0 (21–26)	17.2 (16–18)	20.7 (9.8–26.5)	26.3 (25.6–27.3)	19.6 (17.5–20.8)
<i>Akodon reinhardtii</i>							
Adult males, 3	123.7 (116–126)	48.7 (45–52)	17.0	12.0	15.3 (12.5–17.0)	22.6 (21.7–23.4)	18.2 (17.2–19.1)
Adult females, 3	136.7 (126–145)	49.3 (46–52)	17.3 (16–18)	12.7 (12–13)	19.8 (17.5–22.5)	24.1 (24.0–24.2)	19.9 (19.7–20.2)
<i>Akodon</i> sp. 1							
Adult males, 1	161.0	57.0	20.0	18.0	46.5	29.3	24.5
<i>Akodon</i> sp. 2							
Subadults, 1 female	149.0	54.0	17.0	14.0	30.0	25.0	20.0
<i>Bolomys lasiurus</i>							
Adult males						28.4	
Adult females						27.9	
<i>Calomys callosus</i>							
Adult males, 26	172.2 (132–215)	75.0 (55–95)	20.7 (18–23)	16.1 (14–22)	29.9 (17.0–59.0)	25.8 (22.3–28.9)	20.4 (17.6–23.5)
Adult females, 12	175.8 (157–201)	75.8 (66–83)	20.5 (16–24)	16.1 (14–20)	30.0 (22.7–45.0)	26.2 (23.5–27.9)	20.2 (18.6–21.7)

Table 4. — Continued.

	NL	IB	MB	ZB	PL	DL	MTRL
<i>Dasylops septemcinctus</i>							
Adult males, 1							
<i>Tamandua tetradactyla</i>							
Adult females, 1							
<i>Sybilagus brasiliensis</i>							
Adult males, 1	20.2	16.4	31.5	35.8	29.4	22.4	14.8
Adult females, 1	19.7	15.8	32.4	35.7	29.1	21.7	14.2
Subadults, 1 female	16.5	11.3	28.4	32.5	25.8	18.2	12.5
<i>Akodon cursor</i>							
Adult males, 6	11.6 (10.6–12.3)	5.0 (4.7–5.1)	12.6 (11.5–12.9)	14.8 (13.7–15.9)	12.3 (11.7–13.0)	7.7 (6.9–8.4)	4.7 (4.5–5.2)
Adult females, 4	11.6 (11.1–12.4)	4.9 (4.6–5.1)	12.2 (11.9–12.5)	14.4 (14.4–14.7)	12.1 (11.5–12.5)	7.7 (7.6–7.8)	4.6 (4.3–4.9)
Subadults, 6 (2 males, 4 females)	9.7 (8.4–10.4)	4.7 (4.4–5.0)	11.7 (11.1–12.3)	13.2 (12.0–13.8)	10.3 (9.0–11.0)	6.3 (5.5–7.0)	4.4 (4.2–4.6)
<i>Akodon reinhardtii</i>							
Adult males, 3	8.8 (8.7–8.8)	4.3 (3.7–4.7)	10.5 (10.1–10.9)	11.8 (11.4–12.4)	9.7 (9.3–10.3)	5.7 (5.2–6.4)	4.0 (3.7–4.1)
Adult females, 3	8.9 (8.4–9.4)	4.5 (4.4–4.6)	10.5 (10.3–10.7)	12.5 (12.4–12.5)	10.8 (10.5–11.2)	6.6 (6.2–6.9)	4.1 (4.0–4.2)
<i>Akodon</i> sp. 1							
Adult males, 1	11.1	5.1	12.4	15.4	13.1	8.4	4.6
<i>Akodon</i> sp. 2							
Subadults, 1 female	8.3	4.7		13.2	10.9	6.3	4.7
<i>Bolomys lasiurus</i>							
Adult males	9.7	5.1		15.3	12.9	8.2	4.6
Adult females	9.6	5.0		14.9	12.5	8.1	4.5
<i>Calomys callosus</i>							
Adult males, 26	10.3 (8.4–12.7)	4.3 (3.9–5.1)	11.4 (10.8–11.9)	13.6 (11.7–15.1)	11.1 (9.7–12.9)	6.4 (5.4–7.6)	4.2 (3.9–4.5)
Adult females, 12	10.5 (8.9–12.1)	4.4 (4.0–4.8)	11.4 (10.8–11.7)	13.9 (13.3–14.6)	11.3 (10.5–12.3)	6.4 (5.6–7.1)	4.3 (4.1–4.4)

Table 4.—Continued.

	ToL	TL	HL	E	WT	GSL	BL
<i>Calomys tener</i>							
Adult males, 22	141.4 (115–154)	63.8 (55–69)	16.1 (15–17)	13.7 (11–15)	13.5 (9.0–17.0)	22.7 (21.7–24.3)	16.9 (15.7–18.1)
Adult females, 13	138.3 (126–148)	61.3 (50–70)	16.1 (13–20)	13.4 (11–15)	14.1 (11.5–21.5)	21.9 (21.2–23.4)	16.5 (15.7–17.6)
<i>Holochilus brasiliensis</i>							
Adult males, 2	312.5 (311–314)	145.5 (142–149)	39.0	17.0 (16–18)	175.0 (150.0–200.0)	38.3 (37.8–38.7)	31.5 (31.2–31.7)
Adult females, 1	257.0	126.0	39.0	17.0	130.0	36.6	29.5
Subadults, 2	231.5	113.0	33.3	15.5	40.0	30.7	23.8
(1 male, 1 female)	(219–244)	(110–116)	(31–35)	(15–16)	(35.0–45.0)		(23.7–23.9)
<i>Nectomys squamipes</i>							
Adult males, 18	459.8 (391–494)	234.8 (186–254)	55.6 (53–58)	24.1 (21–26)	350.5 (216.0–521.0)	48.2 (43.4–51.7)	39.2 (34.3–42.0)
Adult females, 6	439.8 (420–459)	226.2 (214–234)	54.0 (53–55)	24.2 (23–25)	295.2 (235.0–344.0)	47.1 (44.7–49.8)	38.3 (36.0–40.1)
Subadults, 3	346.0	173.0	47.0	21.3	130.0	39.4	33.1
(1 male, 2 females)	(295–422)	(147–212)	(43–52)	(19–24)	(78.0–182.0)	(36.6–43.5)	(30.2–35.1)
Juveniles, 3	105.0	34.7	17.0	6.3			
(2 males, 1 female)	(104–106)	(34–36)	(16–18)	(6–7)			
<i>Oryzomys bicolor</i>							
Adult males, 11	204.4 (191–222)	107.4 (96–115)	21.6 (20–23)	15.7 (15–17)	30.6 (21.5–40.7)	27.7 (26.0–29.1)	21.2 (19.8–21.5)
Adult females, 8	199.0 (190–225)	104.4 (98–118)	21.6 (20–23)	14.6 (13–16)	27.6 (23.0–37.9)	26.8 (25.2–27.9)	20.0 (17.5–21.6)
Subadults, 5	162.2 (147–174)	85.4 (82–90)	20.8 (19–22)	13.6 (13–14)	14.8 (11.0–19.5)	24.5 (23.0–25.4)	18.1 (16.8–18.6)
(2 males, 3 females)							
<i>Oryzomys capito</i>							
Adult males, 15	236.5 (210–261)	113.2 (98–122)	29.9 (28–31)	20.7 (19–22)	57.9 (44.0–74.5)	32.4 (30.2–33.9)	25.0 (23.0–26.8)
Adult females, 7	232.7 (217–262)	109.8 (92–127)	28.0 (22–30)	20.4 (17–22)	56.4 (37.7–95.3)	31.4 (29.2–32.3)	24.2 (22.2–25.5)
Subadults, 10	181.0 (158–201)	84.1 (69–97)	26.4 (24–29)	17.6 (16–20)	26.2 (17.5–35.8)	27.6 (24.8–29.8)	20.9 (18.3–23.5)
(6 males, 4 females)							

Table 4. — Continued.

	NL	IB	MB	ZB	PL	DL	MTRL
<i>Calomys tener</i>							
Adult males, 22	8.7 (7.6-9.9)	3.8 (3.5-4.0)	10.1 (9.6-11.6)	11.6 (10.9-12.3)	9.3 (8.6-9.8)	5.2 (4.5-5.8)	3.6 (3.4-3.7)
Adult females, 13	8.4 (8.0-9.0)	3.6 (3.3-3.8)	9.9 (9.6-10.0)	11.6 (11.2-11.9)	9.2 (8.5-9.8)	5.2 (4.9-5.6)	3.5 (3.4-3.6)
<i>Holochilus brasiliensis</i>							
Adult males, 2	14.5 (14.3-14.7)	4.9 (4.7-5.1)	14.8	21.5 (21.4-21.6)	18.9 (18.7-19.0)	11.4 (11.3-11.5)	6.8
Adult females, 1	13.7	4.7	13.9	19.9	17.9	10.7	6.9
Subadults, 2 (1 male, 1 female)	11.6	4.4 (4.3-4.5)	12.7 (12.6-12.8)	17.4 (17.1-17.6)	14.7 (14.6-14.7)	8.0 (7.8-8.1)	6.9 (6.7-7.1)
<i>Nectomys squamipes</i>							
Adult males, 18	20.0 (17.4-21.9)	7.8 (7.3-8.7)	17.4 (16.7-18.4)	25.3 (22.9-27.3)	22.7 (20.7-24.9)	13.3 (11.6-14.4)	7.5 (7.2-8.0)
Adult females, 6	18.8 (16.9-20.0)	7.8 (7.3-8.0)	17.3 (16.8-17.8)	24.9 (23.9-26.6)	22.0 (20.6-22.9)	12.8 (11.9-13.7)	7.6 (7.2-7.9)
Subadults, 3 (1 male, 2 females)	15.1 (14.4-16.0)	6.8 (6.3-7.4)	15.4 (14.8-16.0)	21.4 (19.9-23.3)	18.7 (17.5-20.6)	10.4 (9.4-11.8)	7.5 (7.2-7.8)
Juveniles, 3 (2 males, 1 female)							
<i>Oryzomys bicolor</i>							
Adult males, 11	9.2 (8.3-10.5)	4.9 (4.6-5.1)	11.9 (11.4-12.4)	14.7 (13.8-15.3)	11.5 (11.2-12.2)	7.0 (6.7-7.4)	4.2 (4.0-4.6)
Adult females, 8	8.8 (8.2-9.3)	4.7 (3.8-5.2)	11.5 (10.1-12.1)	14.3 (12.3-15.8)	10.8 (9.2-11.6)	6.6 (5.7-7.3)	4.1 (3.5-4.4)
Subadults, 5 (2 males, 3 females)	7.4 (6.5-7.9)	4.6 (4.5-4.8)	10.9 (10.2-11.3)	12.9 (12.1-13.2)	10.2 (9.7-10.8)	6.1 (5.9-6.3)	4.1 (3.8-4.4)
<i>Oryzomys capito</i>							
Adult males, 15	12.9 (11.7-13.9)	5.5 (5.2-5.7)	12.7 (12.1-13.1)	16.6 (15.4-17.9)	13.7 (12.6-14.4)	8.1 (7.1-8.6)	5.2 (4.9-5.4)
Adult females, 7	12.5 (11.7-13.0)	5.2 (4.8-5.7)	12.4 (11.7-12.7)	16.0 (14.9-16.8)	13.3 (12.6-13.7)	7.8 (7.4-8.3)	5.2 (4.8-5.6)
Subadults, 10 (6 males, 4 females)	10.7 (8.3-12.2)	5.0 (4.8-5.4)	11.6 (10.6-12.6)	14.1 (13.1-14.9)	11.8 (10.6-12.5)	6.8 (5.8-7.8)	5.0 (4.5-5.3)

Table 4.—Continued.

	ToL	TL	HL	E	WT	GSL	BL
<i>Oryzomys chacoensis</i>							
Adult males, 1	221.0	124.0	25.0	17.0	25.5	24.5	18.3
<i>Oryzomys concolor</i>							
Adult males, 4	278.3 (270-287)	146.7 (143-153)	27.8 (26-29)	19.3 (18-21)	67.5 (46.1-95.5)	33.6 (31.8-34.7)	26.1 (24.4-27.1)
Adult females, 3	273.7 (265-281)	145.7 (141-149)	28.0 (27-29)	19.7 (19-20)	55.6 (51.0-61.8)	32.1 (31.6-33.1)	24.6 (23.9-25.6)
Subadults, 2 (1 male, 1 female)	223.0 (205-241)	112.0 (100-124)	27.0 (25-29)	18.0 (17-19)	29.3 (23.5-35.0)	28.6 (27.7-29.5)	21.4 (20.5-22.4)
<i>Oryzomys fornesi</i>							
Adult males, 5	181.0 (167-194)	101.6 (94-115)	22.2 (21-24)	14.0 (13-15)	18.8 (15.5-22.5)	23.5 (23.0-24.2)	17.4 (16.9-18.2)
Adult females, 10	184.2 (169-199)	100.4 (93-111)	21.1 (20-23)	13.2 (11-15)	16.4 (12.0-24.0)	22.5 (21.0-23.7)	17.0 (15.3-18.2)
Subadults, 1 (1 female)	158.0	98.0	20.0	11.0	7.7	20.9	15.5
<i>Oryzomys nigripes</i>							
Adult males, 8	199.3 (191-210)	112.5 (102-120)	23.6 (22-25)	16.0 (15-17)	19.0 (16.0-22.3)	24.4 (23.5-25.5)	18.0 (17.0-19.2)
Adult females, 8	206.6 (194-218)	117.6 (106-131)	24.0 (22-26)	15.5 (14-17)	23.1 (15.6-31.5)	24.7 (23.4-26.0)	18.3 (17.0-19.4)
Subadults, 4 (2 males, 2 females)	166.5 (138-194)	95.0 (82-113)	22.3 (20-25)	13.8 (12-15)	10.8 (5.4-14.9)	23.7	16.5 (15.0-17.6)
<i>Oryzomys subflavus</i>							
Adult males, 5	302.4 (267-338)	154.6 (136-173)	32.8 (31-35)	22.4 (20-25)	85.7 (59.0-106.0)	36.2 (33.7-38.8)	28.2 (26.3-30.9)
Adult females, 7	294.9 (236-338)	159.0 (142-179)	31.3 (30-33)	23.1 (20-31)	86.0 (61.0-114.0)	36.3 (33.6-38.4)	28.0 (25.8-30.0)
Subadults, 1 (1 male)	235.0	120.0	30.0	19.0	31.0		
<i>Oxymycterus roberti</i>							
Adult males, 20	235.4 (210-253)	92.5 (70-105)	28.3 (26-30)	17.6 (13-20)	77.7 (54.0-100.0)	35.1 (32.7-36.9)	27.7 (25.0-29.7)
Adult females, 17	221.9 (196-247)	87.8 (75-110)	27.8 (26-30)	17.3 (15-20)	71.8 (52.0-95.0)	34.3 (31.9-35.8)	27.0 (24.5-28.3)

Table 4. — Continued.

	NL	IB	MB	ZB	PL	DL	MTRL
<i>Oryzomys chacoensis</i>							
Adult males, 1	9.3	3.7	10.4	12.5	9.8	5.8	3.7
<i>Oryzomys concolor</i>							
Adult males, 4	11.1 (10.4–11.6)	6.1 (5.8–6.2)	13.1 (12.5–13.6)	17.7 (16.8–18.3)	14.3 (13.5–14.7)	8.2 (7.8–8.6)	5.4 (5.2–5.5)
Adult females, 3	10.9 (10.7–11.2)	5.7 (5.6–5.8)	12.7 (12.6–12.8)	17.1 (16.8–17.5)	13.4 (13.0–13.7)	7.8 (7.6–8.0)	5.3 (5.1–5.6)
Subadults, 2 (1 male, 1 female)	10.1 (9.2–10.9)	5.5 (5.4–5.5)	12.1 (11.8–12.4)	14.9 (14.5–15.2)	12.0 (11.8–12.2)	6.9 (6.6–7.1)	5.4 (5.2–5.6)
<i>Oryzomys fornesi</i>							
Adult males, 5	8.7 (8.3–9.1)	3.6	10.2 (10.0–10.3)	12.3 (11.9–12.7)	9.5 (9.3–9.9)	5.5 (5.3–6.0)	3.4 (3.2–3.7)
Adult females, 10	8.8 (8.0–9.3)	3.4 (2.8–3.6)	9.9 (9.4–10.3)	12.1 (11.2–12.7)	9.1 (8.5–9.7)	5.4 (4.9–6.1)	3.4 (3.2–3.5)
Subadults, 1 (1 female)	7.8	2.7	9.3	11.1	8.3	4.5	3.4
<i>Oryzomys nigripes</i>							
Adult males, 8	9.3 (8.8–10.0)	3.6 (3.4–3.7)	10.5 (10.2–10.7)	12.7 (12.2–13.2)	9.7 (9.4–10.3)	5.9 (5.5–6.5)	3.7 (3.5–4.0)
Adult females, 8	9.3 (8.7–10.3)	3.7 (3.4–4.0)	10.4 (9.8–11.0)	12.9 (12.1–14.4)	9.8 (9.2–10.8)	5.9 (5.3–6.5)	3.7 (3.6–4.0)
Subadults, 4 (2 males, 2 females)	7.9 (6.6–9.6)	3.5 (3.2–3.7)	10.1 (10.0–10.3)	11.6 (11.0–12.3)	8.9 (8.2–9.4)	5.1 (4.5–5.5)	3.6 (3.5–3.7)
<i>Oryzomys subflavus</i>							
Adult males, 5	13.9 (11.5–16.9)	5.7 (5.5–5.9)	14.2 (13.4–15.2)	18.6 (16.7–20.4)	15.1 (14.3–16.3)	9.1 (8.4–10.2)	5.5 (5.3–5.8)
Adult females, 7	13.9 (13.2–15.0)	5.9 (5.4–6.6)	13.9 (13.1–14.3)	18.9 (17.2–20.5)	15.2 (13.8–16.5)	9.2 (8.4–10.0)	5.3 (5.2–5.5)
Subadults, 1 (1 male)							
<i>Oxymycterus roberti</i>							
Adult males, 20	13.1 (12.0–14.1)	5.8 (5.3–6.4)	13.5 (12.4–14.1)	15.2 (13.6–15.9)	13.5 (12.4–14.5)	8.4 (7.6–9.0)	5.3 (4.7–5.8)
Adult females, 17	12.6 (11.0–14.4)	5.9 (5.5–6.2)	13.5 (12.6–14.0)	14.9 (14.1–16.0)	13.3 (12.2–14.3)	8.3 (7.5–9.2)	5.2 (4.9–5.5)

Table 4.—Continued.

	Tol	TL	HL	E	WT	GSL	BL
Subadults, 7 (4 males, 3 females)	184.3 (135–209)	74.5 (56–85)	26.8 (24–29)	14.7 (8–17)	39.1 (21.3–50.5)	30.8 (26.6–33.0)	23.7 (20.3–25.0)
<i>Rhipidomys mastacalis</i>							
Adult males, 9	281.3 (264–309)	144.3 (117–152)	28.6 (26–30)	19.8 (17–21)	73.2 (52.5–96.0)	34.2 (31.5–36.9)	26.8 (24.2–29.4)
Adult females, 10	276.8 (262–322)	147.6 (132–191)	27.1 (25–29)	19.4 (17–21)	65.5 (57.0–80.9)	33.5 (32.2–35.8)	26.2 (25.1–28.2)
Subadults, 7 (4 males, 3 females)	228.3 (203–255)	123.7 (110–136)	25.7 (22–29)	17.7 (15–20)	32.6 (21.0–44.0)	29.3 (27.5–30.7)	22.4 (20.9–23.6)
<i>Rattus rattus</i>							
Adult males, 2	392.0 (308–404)	183.0 (173–193)	43.5 (42–45)	20.5 (20–21)	260.5 (245.0–276.0)		
<i>Cavia aperea</i>							
Adult males, 2	235.0	0	48.5 (48–49)	24.0 (23–25)	435.0 (400.0–470.0)	62.4 (58.2–66.5)	46.1 (46.0–46.2)
Adult females, 2	213.5 (195–232)	0	44.0 (43–45)	22.5 (22–23)	430.0 (370.0–490.0)	58.4 (57.3–59.5)	46.2 (45.2–47.1)
<i>Chyomys laticeps</i>							
Adult males, 1	278.0	76.0	36.0	14.0		47.3	37.4
Adult females, 1	278.0	70.0	38.0	18.0	201.0		36.8
<i>Proechimys</i> sp.							
Adult males, 1	427.0	169.0	53.0	29.0	427.0		
Adult females, 1	350.3	142.7	47.3	23.2	243.0		
Subadults, 1 (1 male)	225.0	90.0	37.0	20.0	76.0		
<i>Thrichomys apereoides</i>							
Adult males, 3	399.3 (359–429)	174.3 (159–187)	44.3 (42–46)	23.3 (23–24)	335.0 (280.0–375.0)	54.2 (52.1–57.2)	40.0 (37.9–42.4)
Adult females, 3	363.0 (307–404)	150.0 (140–170)	42.0 (40–45)	22.0 (21–23)	211.0 (175.0–239.0)	49.2 (47.5–51.1)	35.9 (34.2–37.9)



Table 4.—Continued.

	NL	IB	MB	ZB	PL	DL	MTRL
Subadults, 7 (4 males, 3 females)	10.9 (8.6–11.6)	5.7 (5.6–6.0)	12.8 (11.4–13.9)	13.8 (13.3–14.2)	11.6 (9.9–12.5)	7.1 (5.7–7.8)	5.1 (4.4–5.5)
<i>Rhipidomys mastacalis</i>							
Adult males, 9	11.6 (10.5–12.7)	5.2 (4.7–5.8)	13.4 (12.5–14.0)	17.9 (16.6–19.0)	13.6 (12.5–15.0)	8.6 (7.7–9.7)	5.4 (5.1–5.6)
Adult females, 10	11.3 (10.5–11.9)	5.3 (4.8–5.6)	13.1 (12.5–13.7)	17.8 (17.2–19.1)	13.5 (12.9–14.4)	8.3 (8.0–8.7)	5.3 (5.1–5.6)
Subadults, 7 (4 males, 3 females)	9.9 (9.0–11.4)	5.2 (5.0–5.3)	12.5 (12.1–12.8)	15.5 (14.6–16.2)	12.1 (11.3–12.6)	7.2 (6.8–7.5)	5.3 (5.0–5.4)
<i>Rattus rattus</i>							
Adult males, 2							
<i>Cavia aperea</i>							
Adult males, 2	17.6 (17.4–17.7)	11.9 (11.8–12.0)	27.2 (25.6–28.7)	32.9 (32.3–33.4)	25.5	15.5 (14.9–16.1)	14.5 (13.9–15.0)
Adult females, 2	17.7 (16.8–18.5)	11.7	26.5	32.8 (32.4–33.1)	25.3 (24.2–26.4)	14.4	14.6 (14.4–14.7)
<i>Clyomys laticeps</i>							
Adult males, 1	13.6	11.3	22.1	25.2	17.1	10.2	9.4
Adult females, 1		11.2	23.4	26.7	17.4	10.7	9.2
<i>Proechimys</i> sp.							
Adult males, 1							
Adult females, 1							
Subadults, 1 (1 male)							
<i>Thrichomys apereoides</i>							
Adult males, 3	18.4 (17.9–19.4)	13.0 (12.0–14.0)	24.1 (23.5–24.5)	28.0 (26.9–29.0)	19.0 (17.3–20.6)	10.9 (9.8–11.9)	9.0 (8.8–9.1)
Adult females, 3	15.8 (15.2–17.0)	11.6 (11.1–12.3)	23.0 (22.1–24.0)	25.5 (24.9–25.9)	16.9 (15.7–18.0)	9.9 (9.2–10.6)	8.8 (8.7–8.8)

**Reproduction.**—Both adult males collected in May had inguinal testes (mean length = 7.5 mm). An adult male collected in June had scrotal testes (length = 11 mm), and a second had inguinal testes (length = 9 mm). Abdominal testes (length = 5 mm) were present in a juvenile male collected in November. Adult females were collected in February ( $n = 1$ ), May ( $n = 1$ ) and August ( $n = 1$ ); a juvenile was captured in October. Reproductive data are available for all females except the specimen collected in January. All had closed vaginas. The female collected in August was pregnant (three embryos, CRL = 5 mm). The sex of one adult specimen was not determined.

**Molt.**—Two individuals were molting in May, and one each in February, June, August and November.

**Ectoparasites.**—The following ectoparasites were collected from this species: Siphonaptera (*Polygenis* sp.); Parasitiformes (*Amblyomma* sp., *Gigantolaelaps guimaraesi* Lizaso, *G. oudemansi* Fonseca, *Laelaps acuminata* Furman, *L. pilifer* Tipton); Acariformes (undetermined species).

**Habitat.**—All specimens from the Federal District were collected in gallery forests; all but two were collected in arboreal traps. The specimen collected from Tres Marias was collected in a terrestrial Sherman trap set in campo sujo. Nitikman and Mares (1987) found that 29% of the captures of this species occurred on the ground and that the species preferred the fern thicket microhabitat within the gallery forest.

**Remarks.**—This species has also been captured in Mato Grosso (Alho et al., 1987; Lacher et al., 1986; Pine et al., 1970; Schaller, 1983).

### *Oryzomys fornesi* Massoia

1973. *Oryzomys fornesi* Massoia, Rev. Invest. Agro. INTA, ser. 1, 10(1):21–37.

**Specimens examined** (16).—FEDERAL DISTRICT: 20 km S Brasília, 7 (OMNH), 8 (UNB), 1 (IBGE).

**Measurements.**—See Table 4.

**Reproduction.**—Adult males were collected in March ( $n = 1$ ; length = 6 mm) and August ( $n = 4$ ; mean length = 7 mm). Pregnant females were collected in March ( $n = 2$ ), September ( $n = 1$ ) and October ( $n = 2$ ); the number of embryos varied from one to four. Crown-rump lengths of individual females averaged 3 and 18, 4, 3 and 4 mm for the months of March, September and October, respectively. Nonpregnant females were collected in March ( $n = 1$ ), August ( $n = 1$ ), September ( $n = 1$ ) and October ( $n = 2$ ). A subadult female was captured in early July.

**Molt.**—Only two adult specimens were found molting; one collected in March was molting posterodorsally and one collected in October was molting on the head. A juvenile collected in July was molting both dorsally and anteroventrally.

**Ectoparasites.**—The following ectoparasites were collected from this species: Anoplura (*Hoplopleura travassosi* (Werneck)); Siphonaptera (*Polygenis* sp.); Parasitiformes (*Ixodes* sp., *Gigantolaelaps peruviana* (Ewing), *Laelaps castroi* Fonseca, *L. paulistanensis* Fonseca, *Mysolaelaps* near *parvispinosus* Fonseca, *Androlaelaps fahrenheitzi* (Berlese)); Acariformes (undetermined species).

**Habitat.**—All specimens were collected in Sherman live traps set on the ground in brejos, campo sujo, cerradão or African grass bordering the gallery forest.

**Remarks.**—The specimen in the IBGE collection is labeled *O. nigripes*. Alho (1981a), Paula (1983), Mello and Moojen (1979), Mello (1977, 1980) and Borchert

and Hansen (1983) listed this species as *O. eliurus*; Dietz (1983) listed all specimens captured as *O. fornesi*. Those individuals captured in cerrado, cerradão and campo habitats are probably *O. fornesi*. Alho et al. (1987) and Lacher et al. (1986) captured this species numerous times in Mato Grosso. The population dynamics of this species in Goiás were studied by Mello (1980).

### *Oryzomys nigripes* (Olfers)

1818. *Mus nigripes* Olfers, in Eschwege, Neue Bibl. Reisenb., 15:209.

*Specimens examined* (20).—FEDERAL DISTRICT: 20 km S Brasília, 6 (OMNH), 7 (UNB); 25 km S Brasília, 3 (OMNH), 3 (UNB). MINAS GERAIS: Tres Marias, Ilhas das Marias, 1 (OMNH).

*Measurements*.—See Table 4.

*Reproduction*.—Two adult males were captured in February; one had inguinal testes (no measurement) and the second had scrotal testes (length = 8 mm). A male with scrotal testes was collected in March (length = 7 mm). A male with inguinal testes (length = 7 mm) and a male with scrotal testes (length = 6 mm) were captured in April. An adult male collected in July had scrotal testes (length = 8 mm); one adult collected in October had inguinal testes (length = 7 mm) and one had scrotal testes (length = 6 mm). Two subadult males were collected in July and October (length = 3 and 6 mm, respectively). Pregnant females were collected in April ( $n = 1$ ), October ( $n = 1$ ) and November ( $n = 2$ ). The number of embryos varied from three to four. A second female collected in October appeared to be lactating. Non-breeding adult females were captured in June ( $n = 1$ ) and July ( $n = 2$ ) and non-breeding subadult females ( $n = 2$ ) were captured in July.

*Molt*.—Adult animals were molting in February ( $n = 1$ ), March ( $n = 1$ ), April ( $n = 1$ ), July ( $n = 2$ ), October ( $n = 3$ ), and November ( $n = 2$ ). Non-molting adults were also found in February ( $n = 1$ ), April ( $n = 2$ ) and October ( $n = 1$ ). Subadults and juveniles were found to be molting in July ( $n = 1$ ) and October ( $n = 1$ ).

*Ectoparasites*.—The following ectoparasites were collected from this species: Anoplura (*Hoplopleura* sp.); Parasitiformes (*Gigantolaelaps wolffsohni* (Oudemansi), *Laelaps paulistanensis* Fonseca, *Laelaps* sp., *Mysolaelaps* near *parvispinosus* Fonseca, *Androlaelaps fahrenheitsi* (Berlese)); Acariformes (undetermined species).

*Habitat*.—All specimens were captured in Sherman traps set on the ground (12 captures) or in trees (7 captures) in gallery forest habitats.

*Remarks*.—Alho (1981a), Paula (1983), Mello (1977, 1980), and Mello and Moojen (1979) listed this species as *O. eliurus*. Dietz (1983) listed this species as *O. fornesi*. Those individuals captured in the gallery forest are probably *O. nigripes*. The population dynamics of this species was studied by Mello (1980).

### *Oryzomys subflavus* (Wagner)

1842. *Hesperomys subflavus* Wagner, Arch. Naturgesch., 8(1):362.

*Specimens examined* (13).—FEDERAL DISTRICT: 15 km S, 3 km E Brasília, 1 (OMNH), 1 (IBGE); 20 km S Brasília, 5 (OMNH), 2 (UNB); 40 km N Brasília, 1 (UNB). GOIÁS: 12 km NE Cristalina, 1 (UNB). MINAS GERAIS: Tres Marias, Ilha das Marias, 2 (UNB).

*Measurements*.—See Table 4.

*Reproduction*.—Males collected in January ( $n = 1$ ; length = 11 mm), March ( $n = 1$ ; length = 21 mm), May ( $n = 1$ ; no measurement), October ( $n = 1$ ; length = 10 mm), and November ( $n = 1$ ; length = 9 mm) had scrotal testes. A subadult

collected in October had testes 4 mm long. Pregnant females were collected in February ( $n = 1$ ), May ( $n = 1$ ) and October ( $n = 2$ ). The number of embryos varied from two to five and CRL ranged from 15 to 35 mm. Mammary glands were large in females collected in February ( $n = 1$ ), March ( $n = 1$ ) and October ( $n = 1$ ). Females collected in March ( $n = 2$ ) and April ( $n = 1$ ) were not pregnant.

*Molt.*—Animals were molting in February ( $n = 1$ ), March ( $n = 3$ ), October ( $n = 3$ ) and November ( $n = 1$ ).

*Ectoparasites.*—The following ectoparasites were collected from this species: Anoplura (*Hoplopleura* sp.); Siphonaptera; Parasitiformes (*Gigantolaelaps vitzthumi*, *Laelaps* n. sp.); Acariformes (undetermined species); Trombiculidae.

*Habitat.*—This species was always captured on the ground in cerrado, campo sujo, brejo or cerradão habitats.

*Remarks.*—On the IBGE Reserve, this species was trapped once in a terrestrial trap but, when released, climbed up into a tree (Fonseca and Redford, 1984). Alho (1981a) and Paula (1983) found this species to be most common in campo habitats. In the Federal District and Goiás, Mello and Moojen (1979) found this species in gallery forest, cerrado, and campo. Mello (1980) also captured this species in Goiás. Dietz (1983) captured several individuals during an ecological study in Minas Gerais. Valle et al. (1982) reported on the population dynamics of this species in Minas Gerais. In Mato Grosso do Sul, Alho et al. (1987) and Lacher et al. (1986) captured this species 37 times.

### *Oxymycterus roberti* Thomas

1901. *Oxymycterus roberti* Thomas, Ann. Mag. Nat. Hist., ser. 7(8):530.

*Specimens examined* (45).—FEDERAL DISTRICT: 20 km S Brasília, 22 (OMNH), 22 (UNB), 1 (IBGE).

*Measurements.*—See Table 4.

*Reproduction.*—Of two adult males collected in January, one had scrotal testes (length = 13.5 mm) and one had inguinal testes (length = 11 mm). Inguinal testes (length = 6, 8 mm) were present in two males in March. A single male captured in April had scrotal testes (length = 11 mm). Of seven males collected in May, one had scrotal (length = 19 mm) and five had inguinal testes (length = 4, 5, 9, 10, 11 mm). Testes length varied from 9 to 11 mm in five of seven adult males collected in August. Two males collected in September had testes lengths of 12 and 14 mm. Subadult males were collected in April ( $n = 2$ ), May ( $n = 1$ ) and August ( $n = 1$ ). Females collected in January ( $n = 4$ ), March ( $n = 4$ ) or April ( $n = 1$ ) were not pregnant, although one of the females captured in March was lactating and one had well-developed mammae. A female collected in May was pregnant (one embryo). Of three adult females collected in August, one was pregnant (two embryos, mean CRL = 2 mm) and had well-developed mammae. Two adult females collected in September were neither pregnant nor lactating. The adult female captured in October was pregnant (four embryos, mean CRL = 29 mm) as was the female collected in November (three embryos, mean CRL = 27 mm). Subadults were captured in July ( $n = 1$ ) and August ( $n = 2$ ).

*Molt.*—Animals were found molting in January ( $n = 5$ ), March ( $n = 4$ ), April ( $n = 1$ ), May ( $n = 6$ ), August ( $n = 3$ ), September ( $n = 1$ ), October ( $n = 1$ ) and November ( $n = 1$ ). Animals not molting were collected in March ( $n = 2$ ), August ( $n = 4$ ) and September ( $n = 2$ ).

*Ectoparasites.*—The following ectoparasites were collected from *O. roberti*: Si-

phonaptera (*Polygenis* sp.); Anoplura (*Hoplopleura fonsecai* Werneck); Coleoptera (*Amblyopinodes* sp.); Parasitiformes (*Ixodes* sp., *Androlaelaps fahrenheitzi* (Berlese), *A. pachyptilae* (Zumpt and Till), *A. foxi* Fonseca); Acariformes (*Oryzomysia oxymycterus* Fain).

*Habitat*.—This terrestrial species was trapped almost exclusively in brejos. Several specimens were trapped in campo limpo (wet and dry) and campo sujo.

*Remarks*.—Fonseca and Redford (1984) found this species to be the most common rodent in the brejos of the IBGE Reserve. Although it was most common in brejos, it was also collected in the cerrado bordering the brejos. Nitikman and Mares (1987) also found *O. roberti* to be a brejo species. Lacher et al. (in press), however, found *O. roberti* in a variety of savanna habitats, although it preferred campo limpo. Thus the species is more of a generalist in its habitat selection than our data suggest. It does seem to prefer either brejos or campo limpo, however, among the many habitats of the cerrado. Paula (1983) found this species restricted to campo, particularly wet campo. Borchert and Hansen (1983) studied this species' microhabitat preferences, food habits, activity patterns, and population changes in response to fire and flood. Dietz (1983) captured individuals in both forest and grassland habitat in Minas Gerais.

### *Rhipidomys mastacalis* (Lund)

1840. *Mus mastacalis* Lund, Kongl. Dansk. Vid. Selsk. Naturv. Math. Afhandl., p. 24.

*Specimens examined* (26).—FEDERAL DISTRICT: 20 km S Brasília, 7 (OMNH), 5 (UNB); 25 km S Brasília, 6 (OMNH), 7 (UNB); 20 km SW Brasília, 1 (IBGE).

*Measurements*.—See Table 4.

*Reproduction*.—Adult males with scrotal testes were collected in April ( $n = 1$ ; length = 16 mm), May ( $n = 1$ ; length = 16 mm), July ( $n = 1$ ; length = 16 mm), October ( $n = 1$ ; length = 17 mm) and November ( $n = 1$ ; length = 16 mm). Adult males with smaller scrotal testes were captured in March ( $n = 1$ ; length = 10 mm) and May ( $n = 1$ ; length = 11.5 mm). Inguinal testes were found in adult males collected in April ( $n = 1$ ; length = 9 mm) and December ( $n = 1$ ; no measurement). Subadult males were collected in January ( $n = 1$ ; no measurement), March (testes abdominal,  $n = 1$ ; length = 5 mm) and October ( $n = 2$ ; length = 6, 11 mm). Pregnant females were captured in February ( $n = 1$ ), July ( $n = 1$ ), August ( $n = 2$ ), September ( $n = 1$ ), October ( $n = 1$ ) and November ( $n = 1$ ). Six females had three embryos each and one had four embryos. The pregnant females collected in September, October and November had small embryos (CRL = 4, 3, 3 mm, respectively). Embryos from females captured in February and August were moderately developed (CRL = 14, 14 and 17 mm, respectively), and embryos from females collected in July were well developed (CRL = 42 mm). An adult female collected in January and two collected in February were not pregnant, although the latter two showed evidence of lactation. Subadult females were collected in April ( $n = 1$ ), May ( $n = 1$ ) and July ( $n = 1$ ).

*Molt*.—Individuals were molting in January ( $n = 1$ ), March ( $n = 1$ ), April ( $n = 3$ ), July ( $n = 1$ ), August ( $n = 1$ ), November ( $n = 1$ ) and December ( $n = 1$ ). Non-molting animals were captured in January ( $n = 1$ ), February ( $n = 3$ ), March ( $n = 1$ ), May ( $n = 3$ ), July ( $n = 1$ ), August ( $n = 1$ ), September ( $n = 1$ ), October ( $n = 4$ ) and November ( $n = 1$ ); no data are available for a specimen collected in July.

*Ectoparasites*.—The following ectoparasites were collected from this species:

Anoplura (*Hoplopleura angulata* Ferris); Parasitiformes (*Ixodes* sp., *Laelaps paulistanensis* Fonseca, *L. thori* Fonseca, *Mysolaelaps heteronychus* Fonseca, *Ornithonyssus bacoti* (Hirst)); Acariformes (undetermined species).

*Habitat*.—This species was found only in the gallery forest.

*Remarks*.—This arboreal species (22 of 26 specimens were captured in traps set in the subcanopy) was captured exclusively within the gallery forest. It is nocturnal. Paula (1983), Alho (1981a), Mello and Moojen (1979), and Dietz (1983) also found this species restricted to the gallery forest of the Federal District, Goiás, and Minas Gerais. Fonseca and Redford (1984) found this species extremely common in the swampy parts of the gallery forest at IBGE. Pine et al. (1970) captured *Rhipidomys* in Mato Grosso.

#### Subfamily Murinae

##### *Mus musculus* Linnaeus

1766. *Mus musculus* Linnaeus, Syst. Nat., 12th ed., 1:138.

*Remarks*.—The house mouse was common in houses and barns; it was never captured in natural habitats. Mello (1980) reported two captures of this species during a study near Formosa, Goiás.

##### *Rattus rattus* (Linnaeus)

1758. (*Mus*) *rattus* Linnaeus, Syst. Nat., 10th ed., 1:61.

*Specimens examined* (2).—FEDERAL DISTRICT: 19 km S Brasília, 2 (OMNH).

*Measurements*.—See Table 4.

*Reproduction*.—Both specimens, collected in late July, had large, scrotal testes.

*Molt*.—No data on molt are available.

*Habitat*.—This peridomestic species is common in natural habitats. Both specimens were captured in Tomahawk traps near barns. One rat was captured and released within a gallery forest at IBGE. However, the capture location was less than 100 m from an orchard.

*Remarks*.—This species was captured during a study near Formosa, Goiás (Mello, 1980) and in Minas Gerais (Valle et al., 1982).

#### Family Erethizontidae

##### *Coendou prehensilis* (Linnaeus)

1758. *Hystrix prehensilis* Linnaeus, Syst. Nat., 10th ed., 1:57.

*Remarks*.—This species was observed foraging in the canopy of a gallery forest at FAL at 0100 hr on 16 June 1984. Schaller (1983) reported the species in the pantanal.

#### Family Caviidae

##### Subfamily Caviinae

##### *Cavia aperea* Erxleben

1777. *Cavia aperea* Erxleben, Syst. Regn. Anim., 1:348.

*Specimens examined* (4).—FEDERAL DISTRICT: 20 km S Brasília, 2 (OMNH), 2 (UNB).

*Measurements*.—See Table 4.

*Reproduction.*—A male collected in March had small scrotal testes; a male captured in August had large scrotal testes (length = 25 mm). Both females captured in January were pregnant with a single embryo (CRL = 22, 17 mm).

*Molt.*—No molting was observed.

*Ectoparasites.*—The following ectoparasites were collected from *Cavia aperea*: Siphonaptera (*Polygenis* sp.); Anoplura (*Hoplopleura imitans* (Werneck)); Mallophaga (*Trimenopon hispidum* (Burmeister), *Gliricola lindolphoi* Werneck, *Gyropus ovalis* Burmeister); Parasitiformes (*Tur amazonicus* Fonseca, *Neoparalaelaps bispinosus* (Fonseca), *Ornithonyssus* prob. *bacoti* (Hirst)); Acariformes (*Chirodiscoides caviae* Hirst).

*Habitat.*—This species was captured in wet campos and brejos, but it is also common in disturbed areas and agricultural lands. All four specimens were collected in African grass surrounding a pond at FAL. Three were trapped using Tomahawk traps and one was stolen from a fox.

*Remarks.*—Paula (1983) captured this species only in gallery forest.

#### Family Hydrochaeridae

##### *Hydrochaeris hydrochaeris* (Linnaeus)

1766. *Sus hydrochaeris* Linnaeus, Syst. Nat., 12th ed., 1:103.

*Remarks.*—Tracks of these large rodents were observed at FAL and IBGE along transitions between gallery forest and brejos. A carcass was found in the gallery forest at IBGE by Fonseca and Redford (1984). They are abundant throughout the pantanal. Information on this species in Brazil is given in Alho (1986). This species was reported by Mello and Moojen (1979) to occur in gallery forest, campo and swamps in the Federal District, Goiás, and Mato Grosso (see also Schaller, 1983).

#### Family Dasyproctidae

##### *Dasyprocta* sp.

*Specimens examined* (2).—FEDERAL DISTRICT: 25 km S Brasília, 1. MATO GROSSO: 115 km S Poconé, 1.

*Measurements.*—See Table 4.

*Reproduction.*—Both females were non-reproductive.

*Molt.*—Neither individual showed signs of molt.

*Habitat.*—Both specimens were collected in gallery forest using Tomahawk traps.

*Ectoparasites.*—The following ectoparasites were collected from this species: Siphonaptera (*Polygenis* sp.).

*Remarks.*—Although no specimens were collected, Fonseca and Redford (1984) reported that this species is frequently seen in orchards on the IBGE reserve. We have been unable to identify our specimens as to species. Mello and Moojen (1979) reported capturing *D. azarae* in gallery forest in Mato Grosso and at several sites in Goiás. *Dasyprocta* sp. were observed by MAM south of Poconé, Mato Grosso. Alho et al. (1987) and Lacher et al. (1986) observed *D. punctata* diurnally in Mato Grosso do Sul.

Family Echimyidae  
Subfamily Echimyinae  
*Clyomys laticeps* (Thomas)

1909. *Echimyus laticeps* Thomas, Ann. Mag. Nat. Hist., ser. 8(4):240.

*Specimens examined* (2).—MATO GROSSO DO SUL: Fazenda Nhumirim, 150 km SE Corumbá, 2 (OMNH).

*Measurements*.—See Table 4.

*Habitat*.—These specimens were taken at the interface of semideciduous tropical forest and savanna, and in isolated forest patches on hummocks.

*Remarks*.—No data are available for these specimens on reproduction, molt or ectoparasites. Alho et al. (1987) and Lacher et al. (1986) reported 20 captures of this species in Mato Grosso do Sul.

*Proechimys* sp.

*Specimens examined* (5).—FEDERAL DISTRICT: 20 km S Brasília, 3; 21 km S Brasília, 1; 20 km SW Brasília, 1.

*Measurements*.—See Table 4.

*Reproduction*.—The juvenile male captured in April had abdominal testes (length = 7 mm). The adult male, captured in September, had inguinal testes (length = 30 mm). Both females captured in February were pregnant with two embryos (mean CRL of each pair = 29, 41 mm). Both females showed little mammary development. A third female, captured in August, was also pregnant with two embryos (mean CRL = 14 mm) and was lactating.

*Molt*.—An adult female collected in February was molting on the head.

*Ectoparasites*.—The following ectoparasites were collected from this species: Anoplura (*Hoplopleura* sp.); Mallophaga (*Gliricola* near *pintoï*); Siphonaptera (*Polygenis* sp.); Parasitiformes (*Tur* sp.); Acariformes (undetermined species).

*Habitat*.—All specimens were trapped in gallery forest in either Sherman traps (4 captures) or Tomahawk traps (1 capture). One individual was found in a Sherman trap which was placed on a log approximately 0.5 m above the ground.

*Remarks*.—Mares et al. (1986), Paula (1983) and Fonseca and Redford (1984) reported that this species is limited to the gallery forest. Fonseca and Redford (1984) identified this species as *P. longicaudatus*, but we have been unable to verify the specific identification of our specimens. The species is common in central Brazil. Mello and Moojen (1979) captured individuals in gallery forest in the Federal District and in Goiás. Alho (1981a) found that *P. roberti* is limited to the gallery forest at FAL.

*Thrichomys apereoides* Lund

1841. *Thrichomys apereoides* Lund, Kongl. Danske. Vid. Selsk. Naturv. Math. Afhandl., 8:98, 242.

*Specimens examined* (6).—GOIÁS: 7 km SE Cristalina, 2 (OMNH), 3 (UNB). MATO GROSSO DO SUL: Fazenda Nhumirim, 150 km SE Corumbá, 1 (OMNH).

*Measurements*.—See Table 4.

*Reproduction*.—Of five adults captured in May, three males had inguinal testes (length = 17, 19, 22 mm), two females were non-reproductive. No information is available for the female collected in the Mato Grosso do Sul.

*Molt*.—None of the specimens were molting.

*Ectoparasites*.—The following ectoparasites were collected from this species:



Mallophaga (*Gyropus* n. sp.); Parasitiformes (*Tur* sp.); Acariformes (undetermined species).

*Habitat.*—Individuals were captured near Cristalina, Goiás, 90 km S of Brasília, in a habitat known as “campo rupestre,” but *Thrichomys apereoides* probably occurs in similar rocky outcrop areas near Brasília. All specimens were captured on the ground at night.

*Remarks.*—Fonseca and Redford (1984) reported collecting two individuals on rocky outcrops on the IBGE reserve. Streilein (1982*a*, 1982*b*, 1982*c*, 1982*d*, 1982*e*) offers a great deal of information on the behavior and ecology of *Thrichomys* in the Brazilian caatinga. He found (Streilein, 1982*c*) that at least some *T. apereoides* were in breeding condition throughout the year, although few females were reproductively active in January or February. Mares et al. (1982) found that *Thrichomys* in the caatinga did not exhibit a seasonal molt; rather it appeared to molt throughout the year. This species has been captured in gallery forest, cerrado and cerradão in the Federal District, Mato Grosso and Goiás (Mello and Moojen, 1979). Mello (1977) found this species in campo rupestre near Formosa, Goiás. Alho et al. (1987) and Lacher et al. (1986) reported one nocturnal observation and 19 captures in Mato Grosso do Sul.

Order Carnivora  
Family Canidae  
Subfamily Caninae

***Cerdocyon thous* (Linnaeus)**

1766. *Canis thous* Linnaeus, Syst. Nat., 12th ed., 1:60.

*Remarks.*—We have observed and/or photographed at least two different species of foxes in the Federal District and in the pantanal. In the pantanal, these may represent *Cerdocyon thous* and *Dusicyon vetulus*, with the possibility of *D. gymnocercus* also occurring in the area. In the Federal District, we would expect *D. gymnocercus* and *C. thous* to occur. However, we are unable to verify species occurrence due to the lack of specimens. Sight records are not always reliable when dealing with foxes due to their variation in color. We therefore note only that at least two, and possibly three, fox species occur in the cerrado. Schaller (1983), Pine et al. (1970), Alho et al. (1987) and Lacher et al. (1986) reported *D. thous* in Mato Grosso.

***Chrysocyon brachyurus* (Illiger)**

1815. *Canis brachyurus* Illiger, Abhandl. Preuss. Akad. Wiss., 1811(1815):109.

*Remarks.*—This species was observed in cerrado habitat at IBGE at 2315 hr on 5 February 1984. This large canid is secretive, but is not considered rare. Fonseca and Redford (1984) reported that this species has been observed in the cerrado of the IBGE reserve and that feces have been found in all habitat types. Maned wolves were observed on the grid at FAL. Schaller (1983) observed a single individual in the pantanal.

Family Procyonidae  
Subfamily Procyoninae  
***Nasua nasua* (Linnaeus)**

1766. *Viverra nasua* Linnaeus, Syst. Nat., 12th ed., 1:64.

*Remarks.*—In the Federal District, coatis were observed at IBGE and a location 40 km N of Brasília. This species was observed and photographed by MAM near Corumbá, Mato Grosso do Sul. Alho et al. (1987) and Lacher et al. (1986) observed coatis 262 times during diurnal censuses in Mato Grosso do Sul. Schaller (1983) found this species to be abundant in the pantanal.

Family Mustelidae  
Subfamily Mustelinae

*Eira barbara* (Linnaeus)

1758. *Mustela barbara* Linnaeus, Syst. Nat., 10th ed., 1:46.

*Remarks.*—Two individuals were seen in cerrado habitat at FAL. This species has been observed on the IBGE reserve in cultivated areas with fruit trees and in the gallery forest (Fonseca and Redford, 1984). Alho et al. (1987) and Lacher et al. (1986) observed this species three times during diurnal censuses in Mato Grosso do Sul. Schaller (1983) also observed this species in the pantanal.

Family Felidae  
Subfamily Felinae

*Leo onca* (Linnaeus)

1758. *Felis onca* Linnaeus, Syst. Nat., 10th ed., 1:42.

*Remarks.*—Jaguar tracks were observed in 1983 south of Poconé in Mato Grosso. Schaller (1983) found the species to be common in the pantanal.

Order Artiodactyla  
Family Cervidae  
Subfamily Odocoileinae

*Blastocerus dichotomus* (Illiger)

1815. *Cervus dichotomus* Illiger, Abhandl. Preuss. Akad. Wiss., 1811(1815):117.

*Remarks.*—MAM observed this species in 1983 in the northern pantanal near Poconé. Alho et al. (1987) and Lacher et al. (1986) observed this deer once during a diurnal census in Mato Grosso do Sul. Schaller (1983) found the species to be fairly common in the pantanal.

*Mazama americana* (Erxleben)

1777. *Moschus americanus* Erxleben, Syst. Regn. Anim., 1:324.

*Remarks.*—This deer was observed on the IBGE reserve. Fonseca and Redford (1984) reported this deer from the cerrado and gallery forests of the IBGE reserve. Alho et al. (1987) and Lacher et al. (1986) censused this deer both diurnally and nocturnally in Mato Grosso do Sul.

*Ozotoceros bezoarticus* (Linnaeus)

1758. *Cervus bezoarticus* Linnaeus, Syst. Nat., 10th ed., 1:67.

*Remarks.*—The pampas deer was observed on the grid at FAL and at IBGE. Several individuals were observed by MAM in the southern pantanal between 100–150 km SE Corumbá. Fonseca and Redford (1984) reported observing this deer singly and in pairs in the campo of the IBGE reserve. This deer was observed

almost exclusively during diurnal censuses in Mato Grosso do Sul (Alho et al., 1987; Lacher et al., 1986). Schaller (1983) reported the species as rare in the pantanal.

#### DISCUSSION

The cerrado, which extends over an area of almost 2 million km<sup>2</sup>, is approximately the size of Mexico, yet it has had few collection-based studies conducted anywhere in the region. Indeed, most of what has been reported is based on research carried out near the Brazilian capital of Brasília, and much of this has been ecologically oriented. In the Neotropics, probably only Amazonia is more poorly known. Pine (1982:28) noted, "Brazil is . . . a vast country. Some portions . . . such as certain areas in the southeast, are relatively well-studied while the great majority, especially the central portions and more especially those areas distant from easily navigable rivers, are very poorly known." We limited our coverage of cerrado mammals to those species for which we had first-hand knowledge or, in the case of the Federal District, that were based on actual museum specimens or sightings of easily identifiable species. This was done in order to begin to provide the foundational data for distribution and habitat selection that are a necessary first step if we are to clarify mammalian distribution patterns in the cerrado.

The cerrado is interesting biogeographically in that it links many diverse communities. It offers a bridge between the semi-arid caatinga of northeastern Brazil and the semi-arid chacoan thorn forest of southern South America (Mares et al., 1981, 1985). The gallery forests of the cerrado support Amazonian elements and provide a habitat connection between the lowland Amazonian rain forest and the unusual rain forest of coastal southeastern Brazil and northeastern Argentina (Mares et al., 1986; Redford and Fonseca, 1986). Recent research has focused on the importance of the cerrado to Brazil's economic welfare, since its grasslands provide extensive grazing lands and a broad region for agricultural development (e.g., Ferri, 1971, 1976; Goodland and Ferri, 1979). Only within the last decade has attention been given to conservation of the fauna of the cerrado, however, even though a national park was established in the Federal District in 1961 (IUCN, 1982). One reason that conservation of the cerrado fauna has not been a high priority could be related to the fact that basic data on species composition, systematics, microhabitat selection, population biology, and other parameters is largely unavailable for this area (e.g., Mares, in press; Mares and Braun, 1986). Without a solid understanding of faunal richness and distribution patterns of species there is little to impel governmental or private efforts to conserve biotic resources in a particular region (Mares, 1986).

Clearly, the cerrado fauna is both rich and diverse. The Federal District has an area of 5814 km<sup>2</sup> (Anon., 1982), about twice the size of Rhode Island, yet in this preliminary survey we have listed 86 species of mammals in 9 orders and 23 families. By comparison, Kentucky, with 104,623 km<sup>2</sup>, supports 63 mammal species, whereas Indiana, with 94,677 km<sup>2</sup>, supports only 54 species (Barbour and Davis, 1974; Mumford and Whitaker, 1982). Our list for the Federal District is far from complete, however. We sampled only sporadically for bats, for example, and expect many more bat species to be recorded. We also expect that our collections of small mammals are incomplete. While we have probably recorded most of the common species, we may well have missed numerous rare ones. More important, our intensive trapping was limited to an area of only a few square

kilometers. Other unpublished research by Mares suggests that the cerrado is a diverse phytogeographic province with shifting patterns of species occurrence. Thus, it is too soon to generalize about biogeographic patterns throughout this huge region from data thus far collected from only a few localities. For example, it is difficult to assess the importance of the cerrado, especially its gallery forests, as being a possible source area for Amazonian species, yet such knowledge is directly applicable to better conservation efforts.

Mares (1982b:535) noted, "... broadscale survey work is vitally needed in order to provide the foundation upon which all other field research is based. It is a sad commentary that the distributional patterns of economically important species are probably better understood by professional hunters than by biologists or game officials . . . a primary research priority (for South America is) an overall survey of the mammals of each country." This report presents one of the initial attempts to describe the fauna of the cerrado based on actual specimen records. We believe that the cerrado plays an important biogeographic role in the maintenance of several of South America's major habitats. Conservation of the fauna of this region should be a matter of the highest priority. Of equal importance is the need for a detailed systematic and ecological survey of the mammals of this region. We hope that this paper will serve as a stimulus for such research in the future.

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*LYREIDUS ALSEANUS* RATHBUN FROM THE  
PALEOGENE OF WASHINGTON AND OREGON, U.S.A.

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ABSTRACT

Forty-four specimens of *Lyreidus alseanus* Rathbun, collected from deep water, offshore, Eocene to Oligocene rocks at ten localities in western Washington and Oregon, provide the first corroboration of the validity of this species. The species can be referred to the *L. channeri* group extending the geographic range of this, the most broadly distributed, species group within the genus. The occurrence of *Lyreidus* in deep water settings in the Eocene tends to suggest that the genus, which first evolved in shallow water habitats, rapidly radiated into deep water environments.

INTRODUCTION

*Lyreidus* is an extant genus of raninid crab that has recently been the subject of a comprehensive study (Griffin, 1970). However, no attempt was made by Griffin to investigate the fossil record of the group. As a result of extensive collecting of Eocene decapods from Antarctica, Feldmann and Zinsmeister (1984) described a new species, *Lyreidus antarcticus*, and summarized information available on fossil representatives of the genus. One pattern that seemed to be well documented was that the genus evolved in high southern latitudes, probably in a high energy, shallow water habitat and, subsequently, radiated into the deeper water, offshore environments typical of the living species. The earliest occurrences of the genus are from Eocene rocks of Antarctica (Feldmann and Zinsmeister, 1984; Feldmann and Wilson, 1988) and New Zealand (Glaessner, 1960, 1980). Living species occupy a variety of sites in the Indo-Pacific region and one species, *Lyreidus nitidus* (A. Milne-Edwards) (= *L. bairdii*) is known from the North Atlantic and Caribbean (Griffin, 1970; Goeke, 1985).

Fossil representatives of the genus have been collected at only a few sites in the northern hemisphere. The only two European species, *Lyreidus hungaricus* Beurlen and *L. paronae* Crema, from Oligocene and Miocene rocks, respectively, are documented by few, moderately well-preserved specimens. Two species, *L. fastigatus* Rathbun (1919) and *L. alseanus* Rathbun (1932), have been described from Oligocene rocks in North America. The former, from the West Indies, is represented by a poorly preserved claw and the latter, from Oregon, was based upon a badly distorted, partial cephalothorax (Fig. 1). Feldmann and Zinsmeister (1984) concluded that this material was inadequate to confirm the generic assignment. Thus, until now there have been no well documented occurrences of *Lyreidus* from North America.

The purposes of this paper are to establish clearly that *Lyreidus alseanus* is, in fact, referable to that genus and to expand upon the description of the species. Because *L. alseanus* has now been collected at ten localities, it is also possible to

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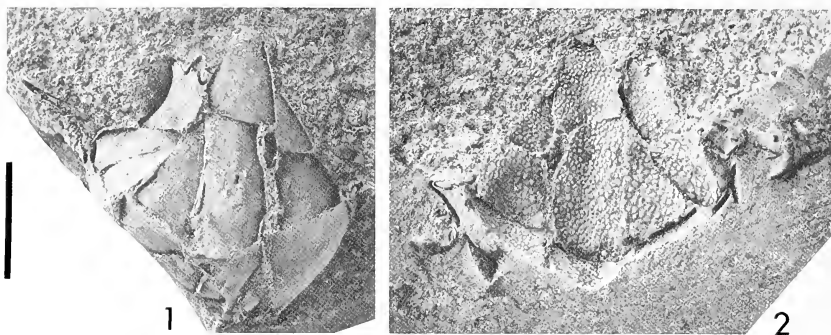


Fig. 1.—*Lyreidus alseanus* Rathbun, holotype, USNM 371901. Part and counterpart of sole specimen upon which the original description was based. Scale bar equals 1 cm.

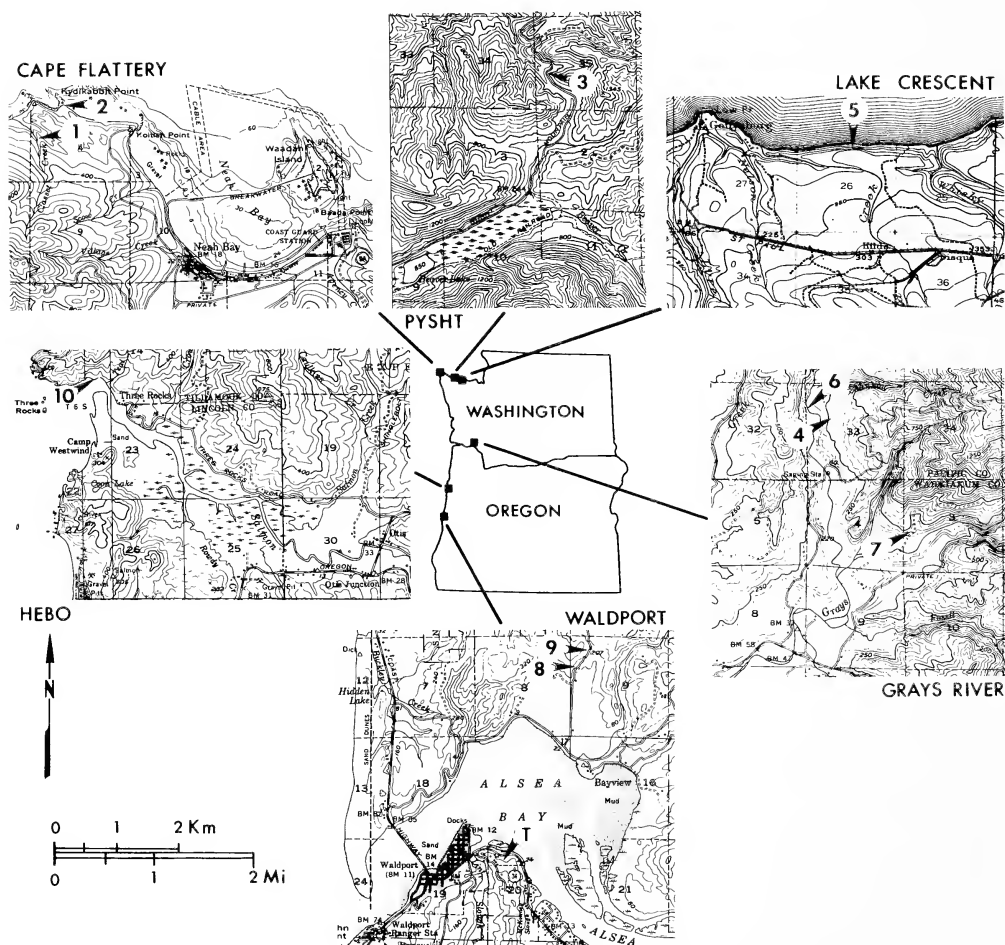


Fig. 2.—Map showing sites in Washington and Oregon, northwestern U.S.A., from which *Lyreidus alseanus* has been collected. The numbered sites are described within the text. The site labelled "T" is the type locality, as described in Rathbun (1932).

describe the range of stratigraphical and paleoecological settings in which it lived and to confirm its systematic assignment.

Miss Rathbun originally based the species upon a crushed, distorted, part and counterpart of the anterior portion of the cephalothorax of one individual. Her assignment of the specimen to *Lyreidus* must have been based on the relatively narrow front, and possession of anterolateral spines, which she described (1932: 240) as, "broad, curving forward." Having carefully examined this specimen several times, I remain convinced that, given only this specimen, it would be nearly impossible to assign this specimen to *Lyreidus* or even to the Raninidae. Within the past several years, additional collecting in the type area, as well as in other fossiliferous localities in Oregon and Washington (Fig. 2), has resulted in the acquisition of 44 specimens which are assignable to *Lyreidus alseanus*. The style of preservation and the manner of fragmentation of some of the specimens is so similar to that of the type specimen that there is little doubt of the association of them with the type specimen.

#### SYSTEMATIC PALEONTOLOGY

Order Decapoda Latreille, 1803

Infraorder Brachyura Latreille, 1803

Section Podotremata Guinot, 1978

Subsection Archeobrachyura Guinot, 1978

Superfamily Raninoidea de Haan, 1839

Family Raninidae de Haan, 1839

Genus *Lyreidus* de Haan, 1830

*Lyreidus alseanus* Rathbun, 1932

Figs. 1.1, 1.2, 3.1–3.8, 4.1, 4.2

**Diagnosis.**—Raninid with tridentate fronto-orbital margin; fusiform carapace outline; hypertrophied, straight, slender, lateral spines; and sinuous anterolateral margin with small spine.

**Description.**—Moderate sized raninid, largest individual with carapace length exceeding 40 mm, greatest width about 60 percent carapace length, narrow front, two pairs anterolateral spines, posteriormost pair hypertrophied and elongate, hexagonal, longitudinally and transversely vaulted carapace. Front narrow, attenuated, about 45 percent maximum carapace width in smaller individuals to about 40 percent maximum width in larger ones, tridentate. Rostrum triangular, about 1½ times as long as wide, subtly sulcate axially, with narrow, well defined rim; postorbital spines parallel or slightly divergent anteriorly, narrow, as long as rostrum; orbits smooth concave arcs interrupted by two fissures abaxial to deepest part of orbits, outermost fissure subtle, at base of postorbital spine, innermost fissure deeper, with depressed margin on some specimens. Anterolateral margin sinuous with protuberant area, developed as small spine or as broadly swollen area, located posterior to midlength, and hypertrophied straight or slightly curved spine at posterior end of anterolateral margin forming about 50° angle with midline of carapace. Lateral margins comprised of two nearly straight elements, anteriormost portion shorter, straight, slightly convergent posteriorly with maximum carapace width developed at anterolateral corner just posterior to spine base; posteriormost portion slightly concave, convergent toward well defined posterolateral corner. Posterior margin narrower than or about equal in width to frontal width, slightly concave. Posterior and posterolateral margins with narrow, well defined, beaded rim. Dorsal surface of carapace generally smooth, axial regions elevated above carapace level, widest in cardiac region, becoming narrower in intestinal region. Branchiocardiac grooves arcuate, well defined, broadest and deepest anteriorly, converging toward axis at midlength and diverging posteriorly. Metabranial region slightly less elevated than remainder of branchial area. Surface of carapace with setal pits, coarsest laterally and axially.

Buccal frame longer than wide, widest at midlength, poorly preserved. Sternum (Figs. 3.8, 4.2) poorly exposed, documented by partial mold of interior, conforming to form of sterna of other species within genus, anterolateral corners appear to be acute.

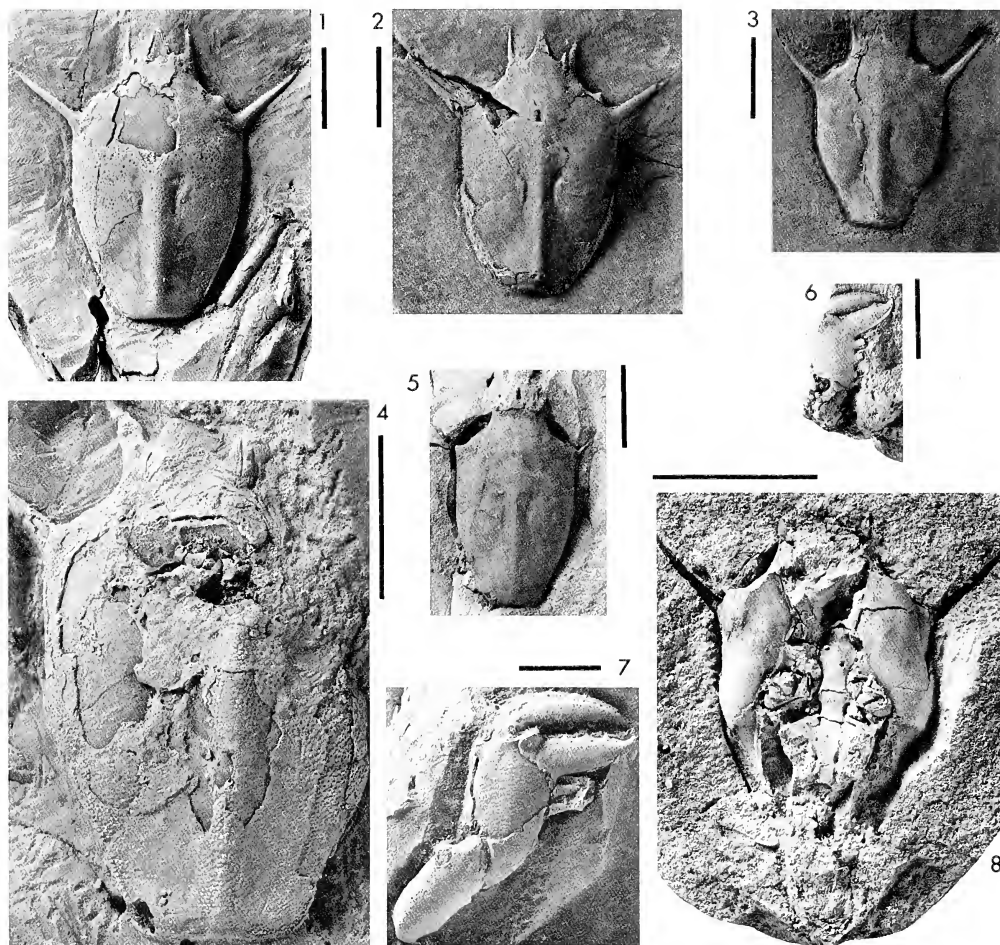


Fig. 3.—*Lyreidus alseanus* Rathbun. 1, dorsal view of USNM 431293. 2, dorsal view of USNM 431294. 3, dorsal view of USNM 431295. 4, dorsal view of USNM 431290. 5, dorsal view of mold of the interior of USNM 431297. 6, outer surface of right cheliped of USNM 431292. 7, outer surface of right cheliped of USNM 431303. 8, ventral view of mold of the interior of USNM 431298. Scale bars equal 1 cm.

Abdomen unknown.

Chelipeds robust, compressed, carpus elongate, widest at carpus-propodus joint, with single prominent spine on upper surface near distal end; propodus widening distally, with three spines on inner surface, distal two about equal in size, prominent, about 33 percent length of fixed finger, proximal spine smaller; fixed finger deflected from axis of propodus with occlusal surface forming angle of about  $82^\circ$  with axis of hand. Dactylus elongate with arcuate upper surface, compressed, bordered by setal pits. Denticles varying in size, but generally triangular, forming serrated occlusal edges; tip of dactylus closing inside tip of fixed fingers. Pereiopods known only from slender, long fragments with nearly circular cross sections.

*Measurements.*—Measurements, in millimeters, are given in Table 1. Orientation of measurements is illustrated in Fig. 4.1.

*Studied specimens.*—Fifteen specimens, USNM 431289–431303, are deposited in the U.S. National Museum of Natural History. Twenty-six additional speci-

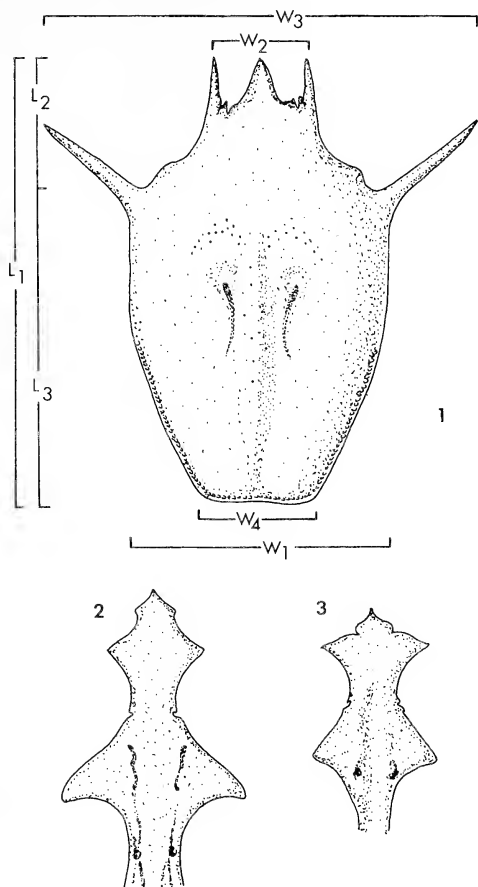


Fig. 4.—1, line drawing the dorsal surface of the carapace of *Lyreidus alseanus*, showing position and orientation of measurements taken. 2, line drawing of the sternum of *Lyreidus alseanus*. 3, line drawing of the sternum of *Lyreidus channeri*.

mens, CM 35530-35555, are curated in the collection of The Carnegie Museum of Natural History.

*Localities and stratigraphic positions.*—Specimens of *Lyreidus alseanus* were collected from localities listed below. At the end of each locality description, initials and numbers denote the collectors: RB = Ross Berglund, JLG = James Goedert, GP = Guy Pierson. Finally, catalogue numbers are given for specimens collected from each of the localities.

1. Hoko River Formation, Eocene, N.W. tip of the Olympic Peninsula, on a ridge-top exposure of “muddy-matrix” breccia adjoining the Neah Bay village sanitary disposal site, several hundred meters inland from the south shore of the Strait of Juan de Fuca, SW¼, NW¼, Sec. 4, T33N, R15W, Cape Flattery 15’ Quadrangle, Clallam County, Washington. RB-32. USNM 431289.

2. Hoko River Formation, Eocene, N.W. tip of the Olympic Peninsula in beach shingle lying along the base of massive exposures of “muddy-matrix” breccia near West Kydikabbit Point, along the Strait of Juan de Fuca, NW¼, NW¼, Sec. 4, T33N, R15W, Cape Flattery 15’ Quadrangle, Clallam County, Washington. U.W. Burke Museum Loc. No. B-3045. RB-33. USNM 431290.

3. Hoko River Formation?, Eocene, thin-bedded siltstones exposed in high bluffs along the Burnt Mountain road north of Beaver Lake, NW¼, SW¼, Sec. 35, T31N, R12W, Pysht 15’ Quadrangle, Clallam County, Washington. Gower (1960) mapped these rocks as part of the lower member of the Twin River Formation. RB-45. USNM 431291.

Table 1.—Measurements, in cm, taken on specimens of *Lyreidus alseanus*. The position and orientation of measurements is illustrated in Figure 4.1.

Specimen	L1	L2	L3	W1	W2	W3	W4
431289	33.1	8.7	24.4	21.7	12.7	35.7	8.0
431290	35.0	7.6	27.4	27.4	—	34.0 <sup>1</sup>	10.4 <sup>1</sup>
431291	ca. 25	8.0	17.0	15.2	6.5	24.2	—
431292	—	ca. 10	—	21.2	7.7	—	—
431293	38.1	11.4	26.7	21.7	8.7	35.4	9.3
431294	34.0	9.7	24.3	20.3	8.6	35.2	8.0 <sup>1</sup>
431295	26.9	6.9	20.0	16.4	7.6	26.7	6.4
431296	37.3	9.7	27.6	ca. 26	—	35.4	10.2 <sup>1</sup>
431297	26.7	6.6	20.1	14.7	6.6	21.4	6.9
431298	—	—	—	12.7	6.2	21.5	—
431300	ca. 26	ca. 8	ca. 18	15.1	6.7	—	ca. 8
431301	—	—	21.0	15.3	6.6	—	6.8
CM 35549	27.2	6.3	21.4	16.3	7.3	—	ca. 7
CM 35550	—	—	20.6	ca. 21 <sup>1</sup>	—	—	—
CM 35551	—	8.5	—	15.5	6.3	—	—
CM 35542	27.1	7.2	19.9	17.5	7.6	—	6.6 <sup>1</sup>
CM 35543	—	—	28.7	26.4 <sup>1</sup>	—	43.0 <sup>1</sup>	—

<sup>1</sup> Width determined by doubling measurement made from midline.

4. "Unit B," Eocene, tuffaceous siltstone in a westerly-facing cut on an extension of the Fish-Hatchery road ca. 400 m east and 530 m south of NW Cor., Sec. 33, in SW¼, NW¼, Sec. 33, T11N, R7W, Grays River 15' Quadrangle, S. E. Pacific County, Washington. Wolfe and McKee (1968) considered these rocks to be "Unit B" and assigned a late Eocene, lower Refugian age. RB-48. USNM 431292.

5. Makah Formation, Oligocene (Refugian), northern side of the Olympic Peninsula, along the Strait of Juan de Fuca, siltstones exposed along bluffs and intertidal zone, between the mouth of the Lyre River and Whiskey Creek, in loose beach rubble, NW¼, NE¼ Sec. 26, T31N, R9W, Disque 7.5' Quadrangle, Clallam County, Washington. Brown, et al. (1960) and Tabor and Cady (1978) mapped the rocks as part of the Makah Formation. RB-67. USNM 431293 and CM 35530-35541.

6. "Unit B," Eocene, stream-cut exposure of tuffaceous siltstone in west bank of Grays River, 1275 m north of SW Cor., Sec. 33 and in NW¼ Sec. 33, T11N, R7W, Grays River 15' Quadrangle, S. E. Pacific County, Washington. Wolfe and McKee (1968) assigned the "Unit B" designation. RB-72. USNM 431294 and 431295 and CM 35542-35545.

7. "Unit B," Eocene, well-indurated marine tuffaceous siltstone in a small quarry in Grays River Valley, approximately 50 m east and 600 m north of SW Cor., Sec. 3, in NW¼, SW¼, Sec. 3, T10N, R7W, Grays River 15' Quadrangle, Wahkiakum County, Washington. Designated "Unit B" and assigned late Eocene, lower Refugian age by Wolfe and McKee (1968). RB-79. USNM 431296 and CM 35546-35548.

8. Nestucca Formation, roadcut exposure of badly weathered shales and siltstones, ca. 530 m south and 100 m east of NW Cor., Sec. 9, T13S, R11W, Waldport 15' Quadrangle, Lincoln County, Oregon. Mapped as Alsea Formation (Snively et al., 1975). JLG-223, RB-84, GP. USNM 431297-431300 and CM 35549-35555.

9. Nestucca Formation, badly weathered shale, in badly slumped and poorly exposed roadcut ca. 300 m south and 280 m east of NW Cor., Sec. 9, T13S, R11W, Waldport 15' Quadrangle, Lincoln Co, Oregon. See comment on 8. JLG-224. USNM 431301.

10. Nestucca Formation, shale exposed at low tide on northeast side of mouth of Salmon River and ca. 100 m north of mouth of Teal Creek, SW¼, Sec. 14, T6S, R11W, Hebo 15' Quadrangle, Tillamook County, Oregon. JLG-226 and JLG-227 (float from beach in vicinity of JLG-226), GP. USNM 431302 and 431303 and two specimens at KSU.

*Remarks.*—Fossil raninids frequently can be assigned to extant genera even though the latter have been defined on the basis of a combination of characters with highly variable preservation potential. In fact, the outline of the fronto-orbital margin, the general conformation of the carapace, and the morphology of the sternum are extremely useful characters in making generic assignments. These

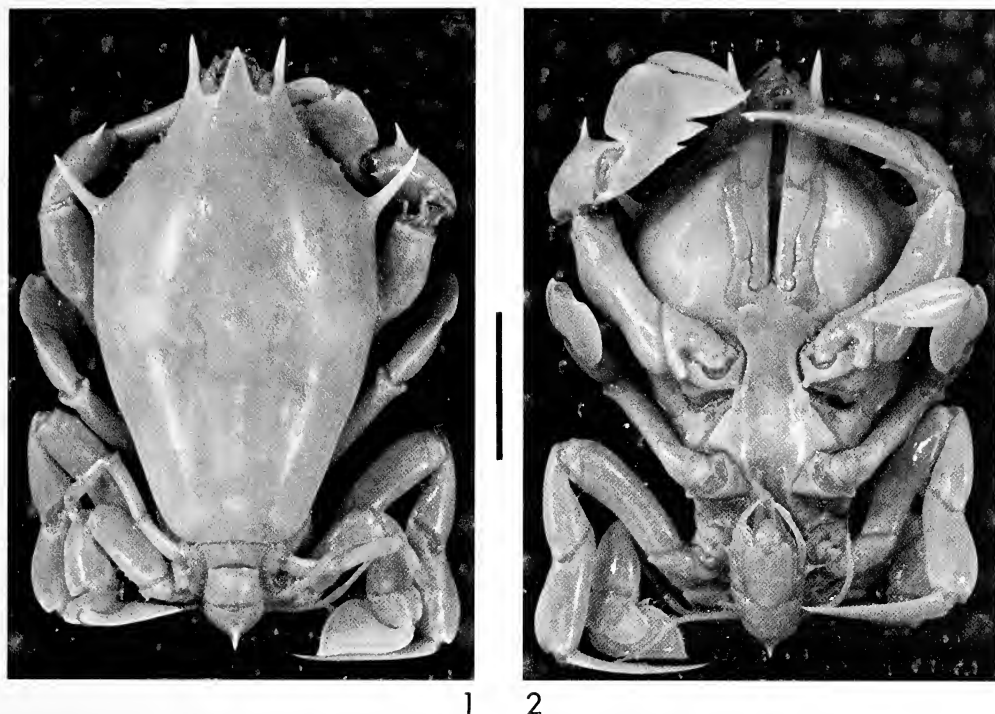


Fig. 5.—Dorsal and ventral views of *Lyreidus channeri* Wood Mason, USNM 216686, collected from a depth of 929 m (508 fm) near the Philippines, North Pacific Ocean.

morphological characters are frequently available for study in fossil forms. *Lyreidus* is characterized by a narrow fronto-orbital margin which typically is attenuated and defined laterally by postorbital spines of approximately the same length as the triangular rostrum. Supraorbital fissures tend to be weakly incised and narrow. The carapace surface is generally smooth and vaulted and the overall fusiform outline of the carapace tends to be more slender than species in most other genera. This elongation is also reflected in the long, generally slender outline of the sternum. In all these regards, *Lyreidus alseanus* conforms closely to the generic descriptors.

The only named genus with which confusion might arise is *Lysirude* Goeke, 1985. This taxon was named to embrace two species previously assigned to *Lyreidus*, *Lyreidus nitidus* (A. Milne-Edwards, 1880) (= *Raninoides nitidus* = *Lyreidus bairdii*) and *Lyreidus channeri* Wood-Mason (1895), and a species named by Goeke, *Lysirude griffini*. The distinguishing characters selected by Goeke (1985: 214) to characterize the new genus include the presence of a granular anterolateral margin with a weakly developed spine and possession of a strongly lobate propodus and dactylus on pereopod 4. However, these characters commonly would be used to make distinctions between taxa at the species, not the genus, level. Therefore, it appears prudent to consider *Lysirude* a junior, subjective synonym of *Lyreidus* until such time as biological material of all relevant species can be examined.

*Lyreidus* has been subdivided into three species groups based upon the relative development of spines in the anterolateral region (Glaessner, 1960; Griffin, 1970). The *L. tridentatus* group, including that species and *L. brevifrons*, comprise species



with a single spine at the anterolateral corner. The *L. stenops* group, comprising only that species, lacks lateral spines altogether. The third group, *L. channeri* group, includes that species, *L. nitidus*, and *L. griffini* and is distinguished by having a strong lateral spine and a sinuous anterolateral margin with a medial protuberance sometimes developed into a spine. Only the *L. stenops* group lacks a fossil record (Feldmann and Zinsmeister, 1984).

*Lyreidus alseanus* must be placed within the *L. channeri* group. The anterolateral margin of *L. alseanus* is sinuous, possesses a hypertrophied lateral spine, and has a weakly developed spine at midlength along the anterolateral margin.

Indeed, *Lyreidus alseanus* is morphologically closely related to *L. channeri* (Fig. 5). The outlines of the carapaces of the two species illustrate only subtle differences. The postorbital spines of *L. alseanus* are about as long as the elongate rostrum. Those spines on *L. channeri* tend to be somewhat longer than the rostrum (Griffin, 1970) but the rostrum of this species is perhaps not as attenuated. The lateral spines of the former tend to be longer, more delicate, and straighter than those of the latter and the posterior margin of *L. alseanus* is, perhaps, somewhat broader. The chelipeds of the two species do differ substantially, however. *Lyreidus alseanus* has claws with three spines along the lower (inner) surface, of which the distal two are long, slender, and nearly equal in size. The proximal spine is reduced. The spines on the lower margin of the propodus of *L. channeri* also number three, but the distal one is stout and substantially larger than the other two (Griffin, 1970). No spines are found on the upper (outer) margin of either species. Distinctions in claw morphology have been used successfully as one point of distinction between species within this genus. Thus, *L. alseanus* is similar to, but can be distinguished from, *L. channeri*.

Two other fossil species are referable to the *Lyreidus channeri* group. *Lyreidus waitakiensis* Glaessner (1980), occurs in Eocene rocks of South Island, New Zealand, and *L. hungaricus* occurs in Oligocene rocks of Hungary. Although both of these species are characterized by the sinuous anterolateral margin, neither has the hypertrophied anterolateral spine of *L. alseanus*. Additionally, Fujiyama and Takeda (1980) described *Ranidina teshimai* from the Poronai Formation, Hokkaido, Japan. The age of the unit has been considered to be Eocene to early Miocene, but a late Oligocene age appears to be most probable (Fujiyama and Takeda, 1980:340). This species lacks the longitudinal keels that characterize the type species of *Ranidina*, *R. rosaliae* Bittner. However, it does bear some resemblance to *Lyreidus alseanus*. The anterolateral spines of *R. teshimai* are extremely long, the anterolateral margins are sinuous and convergent, and the front appears to be narrow and attenuated. The illustration of the sternum (Fujiyama and Takeda, 1980: Plate 40, fig. 2) is difficult to interpret but it also appears to have the general outline of sterna of *Lyreidus* spp. Thus, although it would be inappropriate to suggest that this species is synonymous with *L. alseanus* without examination of the specimens, it is possible to suggest that *R. teshimai* should probably be referred to *Lyreidus*.

The only raninids that have been described from the west coast of the United States that might be confused with *Lyreidus alseanus* are *Ranidina willapensis* Rathbun (1926) and *Eumorphocorystes naselensis* Rathbun (1926). Both of these raninids were based upon incomplete material so that complete comparison is not possible. *Lyreidus alseanus* tends to have a more finely punctate surface than either of these species. In addition the posterolateral and posterior margin is beaded and the posterolateral spine is longer and more slender on *L. alseanus*



than on either *E. naselensis* or *R. willapensis*. Finally, the frontal margin of *Lyreidus* spp. is consistently more delicate, with more subtle supraorbital fissures, than in other raninids. The front is not well known on *R. willapensis* and that on *E. naselensis* bears broad, deep supraorbital fissures and less prominent, curved postorbital spines. Unfortunately, the ventral surface is not visible on specimens from either of these species so that it is not possible to classify them unequivocally.

*Lyreidus channeri* has been collected from a variety of Indo-Pacific sites at depths ranging from 410 to 1030 m (Goeke, 1985). *Lyreidus nitidus*, likewise, is known from moderately deep water. This species has been collected at depths ranging from 119 to 475 m (Griffin, 1970). *Lyreidus alseanus* may, also, have been an inhabitant of bathyal depths. The estimates of depth in which the Hoko River and Makah formations, within the Twin River Group, were deposited include open marine, bathyal settings (Snively et al., 1980). Wolfe and McKee (1972) suggested similar depositional conditions for their unit B. These same rock units have yielded other deep water organisms including foraminiferans (Wolfe and McKee, 1972; Snively et al., 1980) and isopod crustaceans (Wieder and Feldmann, 1989). This occurrence suggests that the limited record of the genus *Lyreidus* in mid-latitude settings may simply reflect lack of available rocks deposited in bathyal habitats.

The discovery of these specimens and the resulting confirmation that *Lyreidus alseanus* inhabited the Pacific coast of North America has several important biogeographic implications. It remains probable that the genus arose in the high latitude habitats of the southern hemisphere (Feldmann and Zinsmeister, 1984). This conclusion is based on the observation that the Eocene occurrences in that region are from inshore, high energy, shallow water habitats which are settings no longer exploited by *Lyreidus*. The pattern of radiation into deeper water, offshore habitats is consistent with the generalization presented by Jablonski et al. (1983). However, previously there has not been any evidence to suggest that the radiation into deep water habitats occurred as early as the Eocene. Thus, available evidence now suggests that the genus arose in shallow water habitats and rapidly expanded its habitat preference into deeper water. Subsequently, the inshore habitats were abandoned.

Finally, it is significant to note that, of the three groups of *Lyreidus* that have been defined, only representatives of the *L. channeri* group have been identified outside the Indo-Pacific region. In fact, this group spans virtually the entire range of the genus; the *L. tridentatus* and *L. stenops* groups are confined to the Indo-Pacific region. It is noteworthy that the extant members of the *L. channeri* group are the species that Goeke (1985) placed in his genus *Lysirude*.

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A NEW SPECIES OF TIGER BEETLE FROM INDIA  
(COLEOPTERA: CICINDELIDAE)

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FABIO CASSOLA<sup>1</sup>

## ABSTRACT

A new species of unusual tiger beetle, *Cicindela* (*Plutacia*) *notopleuralis*, is described from Balasore, Orissa, India. The relationship of this new species to subgenus *Cicindela* (*Plutacia*) and related subgenera are discussed, and superficial similarities to other subgenera within the Cicindelini, Cicindelina are presented.

## INTRODUCTION

In support of the first author's studies of *Cicindela* Linnaeus 1758 (*sensu lato*) of the Indian subcontinent, the second author provided a specimen that he had borrowed from the Muséum National d'Histoire Naturelle, Paris. This single male specimen represents an unexpected and remarkable new species possessing such unusual external characters as to deserve critical examination of its genitalia in relation to the currently known cicindelid fauna of the Indian subcontinent.

Earlier, the specimen on which this paper is based had been examined by Émile Rivalier during his revisionary work on *Cicindela* (*sensu lato*). Although Rivalier never described it, he apparently recognized the specimen as a new species and even considered that it might belong to a new genus, for which he proposed the name *Eucosmia* (*in litteris*). However, the new species described here, despite its unusual external morphological characters, fits within the first author's concept of subgenus *C.* (*Plutacia*), which Rivalier (1961) had established as a monobasic genus for *C.* (*Plutacia*) *dives* Gory 1833, but which the first author presently retains as a subgenus of *Cicindela* in conformity with his revisionary studies of the Indian subcontinent fauna. The decision to place the new species within *Cicindela* (*Plutacia*) is based on the similar morphology of the flagellum within the male genitalia, elytral maculation, cephalo-thoracic surface sculpturing, eye size, femora shape and labral characters.

## SYSTEMATICS

*Cicindela* (*Plutacia*) *notopleuralis*, new species

*Description.*—General habitus (Fig. 1); body size large (20.5 mm, including labrum); dorsum dull black; head laterally with slight green and purple reflections, pronotum laterally shiny green; elytra dull black with pale nonmetallic epipleura, a small yellow-orange humeral macula, and a wide, transverse, yellow-orange macula medially; proepisterna purple, proepimera green, prosternum black, mes-

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episterna purple black, remainder of pterothorax ventrally darker purplish black tinged with metallic green; abdomen reddish purple, nonmetallic.

**Head:** Mandible large (chord length 3.5 mm) and broad (base width 1 mm), tapering abruptly in apical third, apical tooth longest, steeply beveled on inner face and dark pigmented with three broadly rounded teeth between apical tooth and basal molar; maxillary and labial palpi large and pale testaceous except for the shiny black distal segment; medial process of mentum large, broadly acute at apex; labrum (Fig. 2) short, broad with a smooth, even surface, except for a small, shallow depression near base on either side of middle, surface nonmetallic, ivory testaceous except for two darkened areas at base and a wide, dark anterior edge, eight anteromarginal teeth, small to minute and irregularly spaced along anterior margin, middle one the largest and lateral ones grouped on each side, six submarginal setae; antennal scape with six to eight basal setae besides the single, subapical sensory seta, fourth antennomere of male with a penicillum of 16–20 stiff pale reddish bristles, antennomeres nonmetallic, basal four dark reddish, distal seven pale yellow; clypeus glabrous with a slightly wrinkled surface; frons glabrous with parallel, finely raised rugae; vertex with moderately raised rugae forming parallel ridges except for a wide, smooth band at inner margin of eye, rugae near eyes converging anteriorly and not extending onto frons, rugae medially becoming oblique and converging along a central line, rugae behind eyes finer, wavy and confused; genae glabrous with moderately raised, parallel rugae; eyes with a pair of supraorbital setae each at anterior margin and medial concavity; eyes large and flattened, bulging only slightly outward.

**Prothorax:** Pronotal shape subquadrate, almost as wide as long with sides slightly and uniformly arcuate, narrowest at anterior transverse sulcus, and across small, nonbulging posterior angles; surface sculpturing of fine and confused rugae on disc, coarser and slightly wrinkled rugae laterally with a distinct, narrow, highly raised reflexed ridge with numerous short parallel grooves along the entire lateral edge; surface nearly covered with sparse, appressed setae (more numerous at anterior and lateral margins); anterior transverse sulcus shallowly impressed, posterior sulcus more impressed, medial line distinct but shallowly impressed; proepisterna with a wrinkled surface dorsally from finely impressed parallel ridges which are shallow and wavy medially and ventrally, surface nearly glabrous except for scattered long and appressed to semi-erect white setae near anterior margin of coxae; prosternum glabrous; proepimera with long appressed white setae.

**Pterothorax:** Mesepisterna broad, smooth and glabrous except for sparse setae near ventral and posterior margins; mesepimera covered with dense appressed white setae; metepisterna and metepimera glabrous with a slightly wrinkled surface; metasternum laterally covered with long white appressed setae, glabrous medially; scutellum finely rugose with a broad medial depression.

**Elytra:** Shape broadly elongate, widest at apical third with a distinct, slightly obtuse humeral angle and an evenly and broadly rounded outer apical angle; surface dull, velvety black, minutely granulate-punctate with small, noncontrasting black punctures uniformly dense throughout and slightly deeper in basal third, except along black impunctate suture; epipleura pale, nonmetallic; a small yellow-orange humeral spot, and a large yellow-orange spot medially, narrowest near lateral margin and longest near middle, then narrowed and slightly arcuate near suture; apex with small microsculptulations and a broad, short sutural spine.

**Abdomen:** Sterna almost completely glabrous except for scattered, appressed

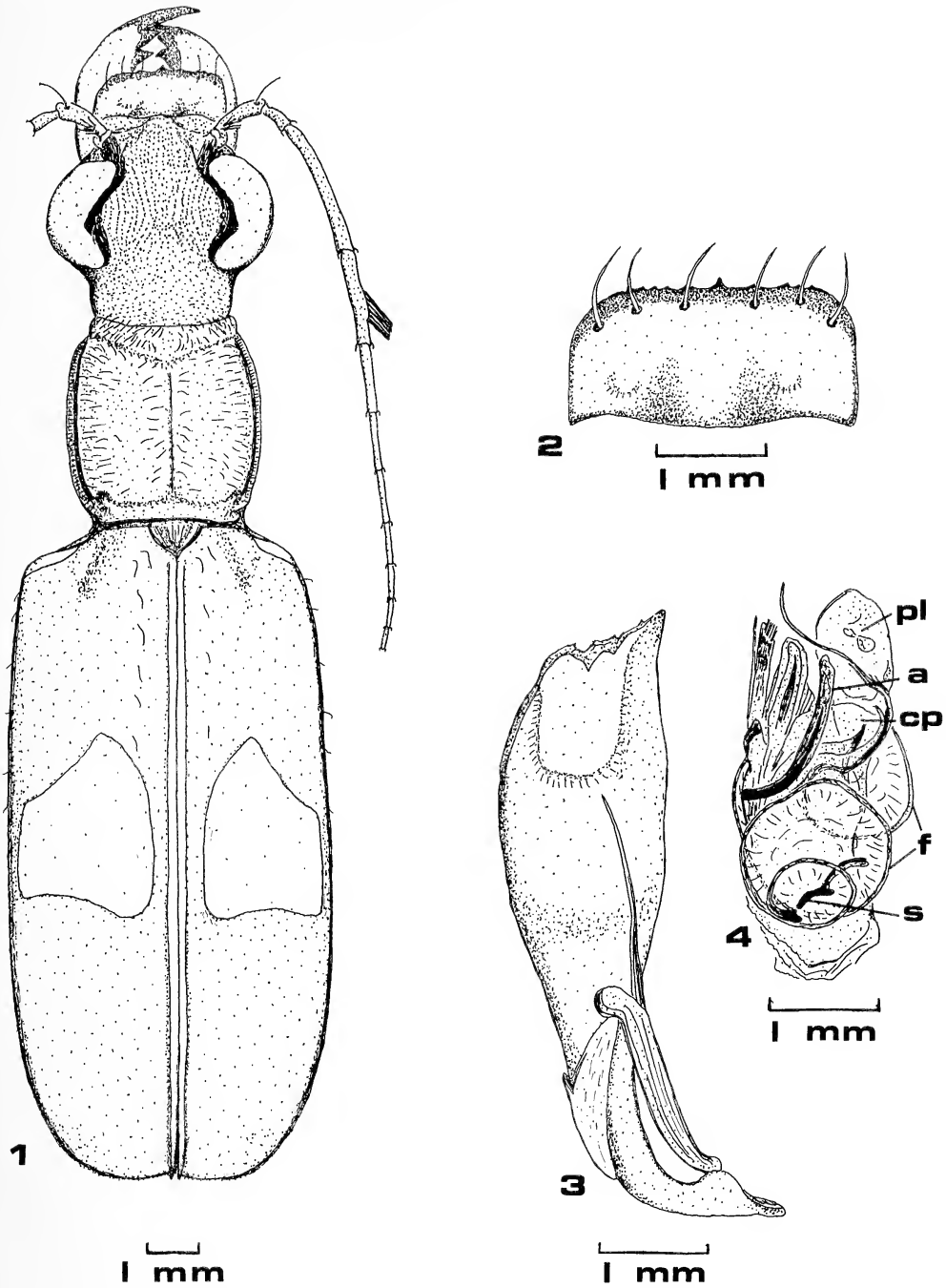


Fig. 1-4.—*Cicindela (Plutacia) notopleuralis*, new species. 1. Habitus of holotype male. 2. Labrum, dorsal view. 3. Aedeagus, left lateral aspect. 4. Internal sac of aedeagus, left lateral aspect. Abbreviations of sclerites' names: a, arciform piece; cp, central plate; f, flagellum; pl, plume; s, stiffening rib.

white setae laterally on basal three sterna and a pair of long sensory setae at center on fourth and fifth sterna; sixth sternum with a broad medial notch.

**Legs:** Coxae with long dense semi-erect white setae; trochanters dark, shiny reddish brown, anterior four without a subapical seta; femora thickened basally, especially anterior pair, surface dark shiny reddish brown with a slight metallic purple tinge and covered with numerous large scattered spines; tibiae shiny purple; tarsi shiny purple, proximal three protarsi of male wide with ventral pads of setae, claws small.

**Male genitalia:** (Interpretation and most terminology from Freitag et al., 1985.) Aedeagus (Fig. 3) relatively huge (length 5.5 mm), narrowest in basal third and gradually enlarged to a bulbous apical half, then abruptly tapering to a broadly truncated apex with a short, acute tip, slightly displaced to the right; a broad, shallowly raised and long flange on left and right lateral aspects extending from apex basally, then perpendicular to, and then parallel to apical orifice such that a broad, shallow concavity is developed medially on both aspects in distal one-quarter of the aedeagus; internal sclerites in left lateral aspect (Fig. 4) consisting of a long, basally curved and apically blunted arciform piece, a large central plate with stylets on the left, a large membranous plume on the right, an elongate and highly convoluted flagellum forming several spirals supported by sustaining membranes on both the left and right lateral aspects, one of which raises a large, auricular, membranous lobe medially in the right lateral aspect, a small stiffening rib at the base of the flagellum.

**Type specimen.**—Holotype male labelled “Balasore, R.P. Gengler” (two typeset lines within a thin black submarginal line); “edéage 1180, Rivalier” (two hand-printed lines); “1180” (handwritten) with male genital capsule glued onto stiff cardboard label; “MUSEUM PARIS” (typeset); “HOLOTYPUS *Cicindela*, (*Plutacia*), *notopleuralis* n.sp., R.E. Acciavatti & F. Cassola ded., 1988” (six typeset and handprinted lines on red label). The internal sac of the male genitalia was prepared by Rivalier, and resides on a slide which is separate from the holotype and had been labelled “1180, species?, de Balasore, Inde, 1.XII.57” (five hand-script lines on right side); “HOLOTYPUS *Cicindela*, (*Plutacia*), *notopleuralis* n.sp., R.E. Acciavatti & F. Cassola ded., 1988” (six typeset and handprinted lines on red label on the left side).

**Type depository.**—Holotype male with male genitalic slide preparation 1180 deposited at the Muséum National d'Histoire Naturelle, Paris.

**Type locality.**—Balasore, Balasore District, Orissa, India.

**Distribution.**—Known only from the type locality in eastern Orissa, India.

**Etymology.**—This species name was given with reference to the numerous, short parallel grooves on the narrow, raised reflexed ridge along the entire notopleural suture.

**Diagnosis.**—*Cicindela* (*Plutacia*) *notopleuralis* is most similar to *C. (Plutacia) dives* in having within the male genitalia a large, bulky internal sac containing a long, convoluted flagellum ensheathed by membranes and spiralled to form large, rounded lobes lying freely within the sac on both lateral aspects; two lobes unequal in size on the left aspect and a large one creating an auricular lobe medially in the right aspect. Furthermore, the two species have wide, transverse elytral maculae, moderately to coarsely sculptured head and pronotum, and a broad flattened labrum with six submarginal setae, and feeble teeth which vary in number, size and placement along the anterior margin.

Whereas the morphology of the flagellum and labrum, as well as, head and pronotal sculpturing and elytral maculation, unite these two species within *Cic-*

*indela* (*Plutacia*), *C. notopleuralis* can be distinguished from *C. dives* by the following external characters: 1) larger body size; 2) antennal scape with numerous basal setae rather than being glabrous basally; 3) penicillum of stiff bristles on the fourth antennomere of the male; 4) narrower labrum with less defined teeth and six differently arranged subapical setae; 5) less coarsely sculptured head and pronotum with an unusual raised reflexed and striated ridge along the lateral edge of the pronotum; 6) body mostly glabrous with sparse areas of appressed setae rather than being almost completely covered with scattered, erect and semi-erect setae; 7) humeral spot and one broad elytral macula rather than three narrow, obliquely transverse markings which almost touch the lateral margin, and correspond to the humeral and apical lunules, and middle band; 8) anterior four trochanters glabrous rather than each with a subapical seta; 9) male genitalia with a large, bulbous capsule at the distal end rather than at the proximal end.

*Discussion.*—*Cicindela* (*Plutacia*) possesses morphological characters which define its distinctiveness. Its male genitalic structure unite it naturally to certain subgenera of tribe Cicindelini Sloane 1906, subtribe Cicindelina W. Horn 1908. Resemblance to other subgenera is only superficial and not substantiated by important sexual features of the male genitalia.

The following morphological characters define *Cicindela* (*Plutacia*): 1) auricular form of the flagellum within the male genitalia; 2) wide, transverse elytral maculae; 3) moderately to coarsely sculptured head and pronotum; 4) flattened, slightly bulging eyes; 5) large, basally thickened femora; 5) broadly flattened, hexachaetous labrum with numerous small and irregularly spaced teeth.

*Cicindela* (*Plutacia*) is most naturally grouped with other subgenera in which the male genitalia form an auricular flagellum. These include: *Cicindela* (*Cosmodela*) Rivalier 1961, *Cicindela* (*Lophyra*) Motschulsky 1859 and *Cicindela* (*Lophyridia*) Jeannel 1946. *Cicindela* (*Plutacia*) is distinguished from *Cicindela* (*Cosmodela*) by the latter having a finely rugose head and alutaceous pronotum, rounded, dorsally protruding eyes, long slender femora, and a labrum with three to five large marginal teeth and often with a medial carina. *Cicindela* (*Plutacia*) is distinguished from *Cicindela* (*Lophyra*) by the latter having three acute mandibular teeth distal of basal molar, elytral maculation forming distinct or broadly fused lateral lunules and discal spots, and a labrum with three small teeth medially and four to six submarginal setae. *Cicindela* (*Plutacia*) is distinguished from *Cicindela* (*Lophyridia*) by the latter possessing a very finely rugose to alutaceous head and pronotum, large and bulging eyes, elytral maculae with a marginal band and complete or fragmented lunules extending onto disc, labrum usually with ten or more submarginal setae.

Based on external characters, *Cicindela* (*Plutacia*) superficially resembles certain members of the Indian *Cicindela* (*Pancallia*) Rivalier 1961 and *C. (Ancyliia)* Rivalier 1961 in certain of their external morphology. In particular, for *Cicindela* (*Plutacia*) *notopleuralis* the lack of subapical setae on the trochanters, black body color, elytral markings and sparse ventral body setae resemble *C. (Pancallia) princeps* Vigors 1825 as well as *C. (Ancyliia) andrewesi* W. Horn 1894 (form *unica* Fleutiaux 1895); whereas for *C. (Plutacia) dives* Gory 1833 the coarse dorsal surface sculpturing of the body and pattern of elytral markings resemble *C. (Ancyliia) calligramma* Schaum 1861. These similarities are only superficial, however, as the male genitalia of these two other subgenera possess a simple, short, thickened and hook-shaped flagellum rather than the much more highly developed, spiralled and convoluted flagellum forming auricular lobes as found in *Cicindela* (*Plutacia*).

In the presence of a penicillum, *C. (Plutacia) notopleuralis* has to be added to

the small number of cicindelid species (mostly belonging to *Cicindela* subgenera *Lophyra* Motshulsky, *Lophyridia* Jeannel and *Chaetodera* Jeannel 1946) which possess such a non-genitalic mating structure (Cassola, 1980).

#### ACKNOWLEDGMENTS

We wish to extend our sincere appreciation to Mlle. Hélène Perrin, Muséum National d'Histoire Naturelle, Paris, for the opportunity to examine the specimen on which this paper is based. The critical comments on the manuscript provided by John Rawlins and Robert Davidson, Invertebrate Zoology Section, Carnegie Museum of Natural History, were valuable and much appreciated.

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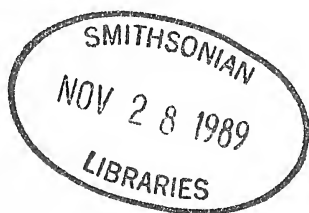
VOLUME 58

17 NOVEMBER 1989

ARTICLE 4

## CONTENTS

Art. 4. The tiger beetle genus <i>Cicindela</i> (Coleoptera, Insecta) from the Indian subcontinent . . Robert E. Acciavatti and David L. Pearson	77
Index to Volume 58 .....	355



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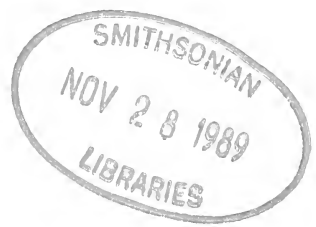
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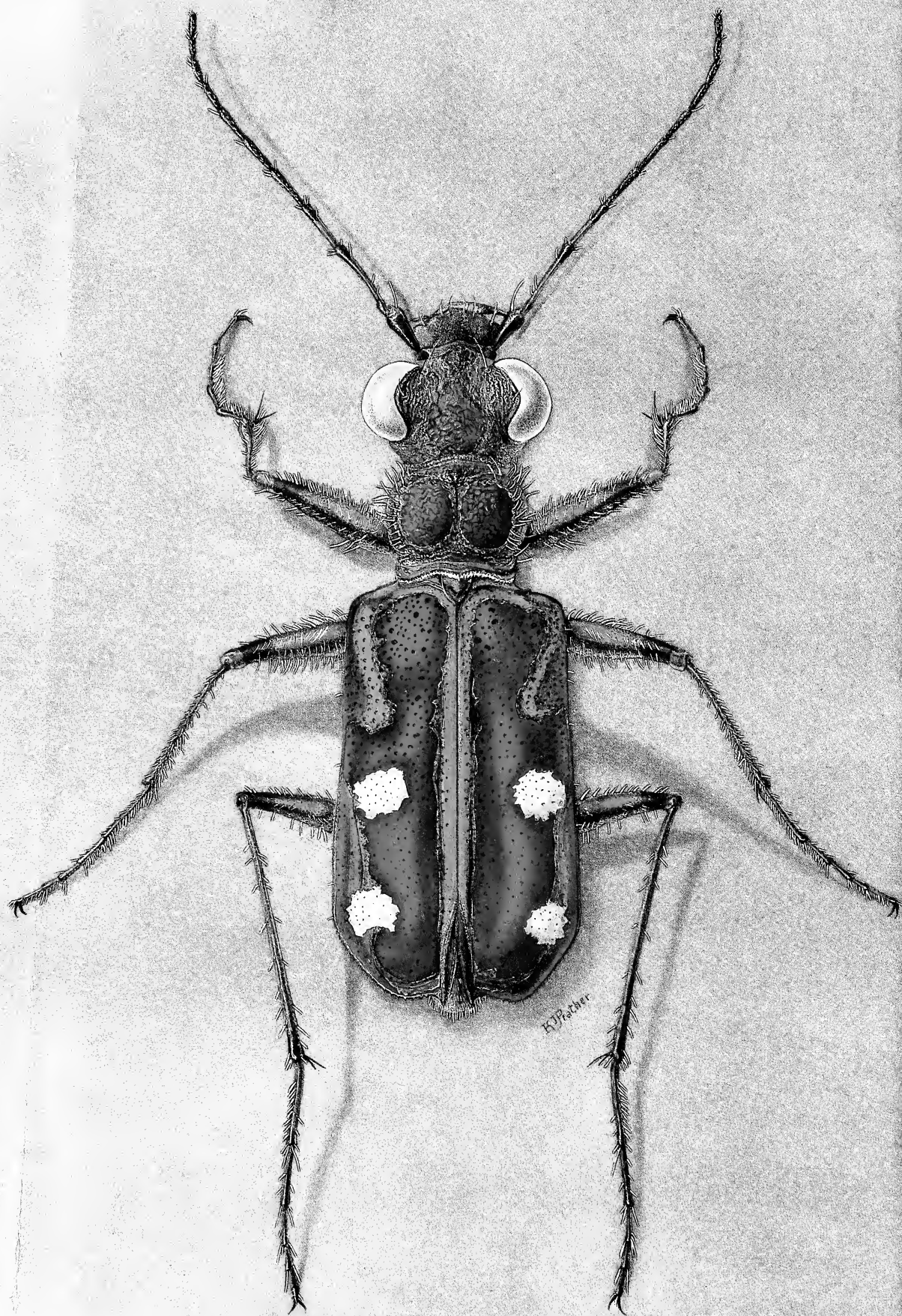


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Frontispiece—*Cicindela (Jansenia) sandurica*, new species, male holotype from Sandur, Bellary District, Karnataka, India. (Body size, 8.5 mm.)



THE TIGER BEETLE GENUS  
*CICINDELA* (COLEOPTERA, INSECTA)  
FROM THE INDIAN SUBCONTINENT

ROBERT E. ACCIAVATTI<sup>1</sup>

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CONTENTS

Abstract .....	81
Introduction .....	82
Methods .....	84
External characters .....	85
Internal characters .....	89
Distribution and ecology .....	89
Systematics .....	91
Key to adults of Indian subcontinent <i>Cicindelini</i> genera .....	91
Key to adults of Indian subcontinent <i>Cicindela</i> ( <i>sensu lato</i> ) subgenera ..	97
Subgenus <i>Cicindela</i> Linnaeus, 1758 .....	101
<i>granulata stoliczkana</i> Bates, 1878 .....	101
Subgenus <i>Sophiodela</i> Nakane, 1955 .....	102
<i>cyanea</i> Fabricius, 1787 .....	103
Subgenus <i>Pancallia</i> Rivalier, 1961 .....	104
<i>princeps</i> Vigors, 1825 .....	104
<i>aurofasciata</i> Dejean, 1831 .....	105
<i>angulicollis</i> Horn, 1900 .....	107
<i>shivah</i> Parry, 1848 .....	108
Subgenus <i>Ancylia</i> Rivalier, 1961 .....	109
<i>guttata</i> Wiedemann, 1823 .....	109
<i>andrewesi</i> (Horn, 1894) .....	110
<i>calligramma</i> Schaum, 1861 .....	112
<i>ceylonensis</i> Horn, 1892 .....	113
<i>diversa</i> Horn, 1904 .....	114
Subgenus <i>Calochroa</i> Hope, 1838 .....	115
<i>octonotata</i> Wiedemann, 1823 .....	116
<i>flavomaculata</i> Hope, 1831 .....	117
<i>sempunctata</i> Fabricius, 1775 .....	119
<i>whithillii</i> (Hope, 1838) .....	120
<i>tritoma</i> Schmidt-Goebel, 1846 .....	121
<i>assamensis</i> Parry, 1844 .....	122
<i>octogramma</i> Chaudoir, 1852 .....	123

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Submitted 17 January 1989.

<i>fabriciana</i> Horn, 1915 .....	124
<i>bicolor</i> Fabricius, 1781 .....	125
<i>hamiltoniana</i> Thomson, 1857 .....	127
<i>discrepans</i> Walker, 1858 .....	128
<i>lacrymans</i> Schaum, 1863 .....	129
Subgenus <i>Cosmodela</i> Rivalier, 1961 .....	130
<i>aurulenta juxtata</i> , new name .....	131
<i>virgula</i> Fleutiaux, 1893 .....	132
<i>intermedia</i> Chaudoir, 1852 .....	133
<i>fleutiauxi</i> Horn, 1915 .....	134
<i>duponti</i> Dejean, 1826 .....	136
Subgenus <i>Plutacia</i> Rivalier, 1961 .....	137
<i>dives</i> Gory, 1833 .....	138
<i>notopleuralis</i> Acciavatti and Cassola, 1989 .....	138
Subgenus <i>Chaetodera</i> Jeannel, 1946 .....	139
<i>albina</i> Wiedemann, 1819 .....	140
<i>vigintiguttata</i> Herbst, 1806 .....	141
Subgenus <i>Lophyra</i> Motschulsky, 1861 .....	142
<i>catena</i> Fabricius, 1775 .....	143
<i>cerina</i> (Naviaux and Acciavatti, 1987) .....	145
<i>striatifrons</i> Chaudoir, 1852 .....	145
<i>histrion</i> Tschitscherine, 1903 .....	146
<i>cancellata</i> Dejean, 1825 .....	147
Subgenus <i>Spilodia</i> Rivalier, 1961 .....	149
<i>striolata</i> Illiger, 1800 .....	150
<i>lineifrons</i> Chaudoir, 1865 .....	151
<i>parvimaculata</i> Fowler, 1912 .....	152
<i>lefroyi</i> Horn, 1908 .....	153
<i>vittigera</i> Dejean, 1825 .....	154
<i>multiguttata</i> Dejean, 1825 .....	155
Subgenus <i>Lophyridia</i> Jeannel, 1946 .....	156
<i>angulata</i> Fabricius, 1798 .....	157
<i>fowleri</i> Heynes-Wood and Dover, 1928 .....	159
<i>plumigera</i> Horn, 1892 .....	160
<i>cardoni</i> Fleutiaux, 1890 .....	163
<i>chloris</i> Hope, 1831 .....	164
<i>funerea</i> MacLeay, 1825 .....	166
<i>fischeri elongatosignata</i> Horn, 1922 .....	167
<i>littoralis conjunctaepustulata</i> Dokhtourov, 1887 .....	168
<i>aulica</i> Dejean, 1831 .....	169
<i>quadripunctulata</i> Mandl, 1971 .....	170
Subgenus <i>Jansenia</i> Chaudoir, 1865 .....	171
<i>westermanni</i> (Schaum, 1861) .....	178
<i>pseudodromica</i> Horn, 1932 .....	180
<i>corticata</i> (Putzeys, 1875) .....	180
<i>dasiodes</i> , new species .....	181
<i>semisetigerosa</i> , new species .....	185
<i>vestiplicata</i> , new species .....	187
<i>legnotia</i> , new species .....	190
<i>plagatima</i> , new species .....	192



<i>ostrina</i> , new species	194
<i>corrugatosa</i> , new species	196
<i>cratera</i> , new species	198
<i>cirrhidia</i> , new species	201
<i>stellata</i> , new species	203
<i>laeticolor</i> Horn, 1904	205
<i>choriodista</i> , new species	206
<i>prothymoides</i> Horn, 1908	208
<i>crassipalpis</i> Horn, 1908	209
<i>tetrastacta</i> Wiedemann, 1823	210
<i>chlorida</i> Chaudoir, 1865	211
<i>psarodea</i> , new species	212
<i>rostrulla</i> , new species	214
<i>grossula</i> Horn, 1925	216
<i>venus</i> Horn, 1907	216
<i>stuprata</i> Horn, 1909	217
<i>fusissima</i> , new species	218
<i>chloropleura</i> Chaudoir, 1865	220
<i>viridicincta</i> Horn, 1894	221
<i>azureocincta</i> Bates, 1878	222
<i>rugosiceps</i> Chaudoir, 1865	223
<i>sandurica</i> , new species	224
<i>motschulskyana</i> Horn, 1915	225
<i>indica</i> Fleutiaux, 1893	226
<i>reticulella</i> , new species	228
<i>tetragrammica</i> Chaudoir, 1865	230
<i>applanata</i> , new species	231
Subgenus <i>Glomera</i> , new subgenus	233
<i>belloides</i> (Horn, 1907)	234
<i>ochrocnemis</i> , new species	235
Subgenus <i>Setinteridenta</i> Acciavatti, 1987	237
<i>rhytidopteroides</i> Horn, 1924	237
Subgenus <i>Oligoma</i> Rivalier, 1961	238
<i>paradoxa</i> Horn, 1892	238
<i>lacunosa</i> Putzeys, 1875	239
Subgenus <i>Cylindera</i> Westwood, 1831	240
<i>descendens</i> Fischer, 1825	241
<i>armandi</i> Fairmaire, 1886	242
<i>dromicoides</i> Chaudoir, 1852	243
<i>delavayi</i> Fairmaire, 1886	244
Subgenus <i>Ifasina</i> Jeannel, 1946	245
<i>foveolata</i> Schaum, 1863	250
<i>cyclobregma</i> , new species	251
<i>viduata</i> Fabricius, 1801	253
<i>viridilabris</i> Chaudoir, 1852	255
<i>labioaenea</i> Horn, 1892	256
<i>fallaciosa</i> Horn, 1897	257
<i>severini</i> Horn, 1892	258
<i>collicia</i> , new species	259
<i>nietneri</i> Horn, 1894	262

<i>belli</i> Horn, 1894	263
<i>umbropolita</i> Horn, 1905	264
<i>ganglbaueri</i> Horn, 1892	266
<i>dormeri</i> Horn, 1898	267
<i>henryi</i> Horn, 1925	268
<i>waterhousei</i> Horn, 1900	268
<i>willeyi</i> Horn, 1904	269
<i>seriepunctata</i> Horn, 1892	270
<i>melitops</i> , new species	271
<i>spinolai</i> Gestro, 1889	273
<i>paucipilina</i> , new species	274
<i>limitisca</i> , new species	276
<i>subtilesignata</i> Mandl, 1970	279
<i>decempunctata</i> Dejean, 1825	280
<i>anelia</i> , new species	281
<i>sikhimensis</i> Mandl, 1982	283
<i>kaleea</i> Bates, 1866	284
Subgenus <i>Eugrapha</i> Rivalier, 1961	285
<i>bigemina</i> Klug, 1834	287
<i>brevis</i> Horn, 1905	288
<i>procera</i> Horn, 1905	289
<i>minuta</i> Olivier, 1790	291
<i>cognata</i> Wiedemann, 1823	292
<i>erudita</i> Wiedemann, 1823	294
<i>agnata</i> Fleutiaux, 1890	295
<i>ancistridia</i> , new species	296
<i>venosa</i> Kollar, 1836	298
<i>grammophora</i> Chaudoir, 1852	300
<i>singalensis</i> Horn, 1911	301
<i>sublacerata</i> Solsky, 1874	302
Subgenus <i>Eriodera</i> Rivalier, 1961	303
<i>albopunctata</i> Chaudoir, 1852	304
Subgenus <i>Monelica</i> Rivalier, 1950	305
<i>fastidiosa</i> Dejean, 1825	305
Subgenus <i>Myriochile</i> Motschulsky, 1862	307
<i>melancholica</i> Fabricius, 1798	308
<i>undulata</i> Dejean, 1825	309
<i>dubia</i> Horn, 1892	310
<i>atelesta</i> Chaudoir, 1854	311
<i>distinguenda</i> Dejean, 1825	313
Subgenus <i>Salpingophora</i> Rivalier, 1961	314
<i>maindroni</i> Horn, 1897	315
<i>bellana</i> Horn, 1905	316
Subgenus <i>Hypaetha</i> LeConte, 1860	317
<i>quadrilineata</i> Fabricius, 1781	318
<i>biramosa</i> Fabricius, 1781	319
<i>copulata</i> Schmidt-Goebel, 1846	320
<i>ornatipennis</i> Schilder, 1953	321
Subgenus <i>Callytron</i> Gistel, 1848	322
<i>limosa</i> Saunders, 1836	322

<i>gyllenhalii</i> Dejean, 1825 .....	323
<i>malabarica</i> Fleutiaux and Maindron, 1903 .....	324
Doubtful records .....	325
Acknowledgments .....	341
Literature cited .....	341
Index to taxa .....	350

### ABSTRACT

*Cicindela* (*sensu lato*) species and subspecies of tiger beetles known from the Indian subcontinent countries of India, Pakistan, Nepal, Bhutan, Bangladesh, and Sri Lanka, are reviewed comprehensively. The 151 species are organized into 24 subgenera with taxonomic keys provided to differentiate *Cicindela* from other Cicindelini, Cicindelina genera and to identify its members to the subgeneric and specific levels. Each subgenus and its included species are covered in detail as to nomenclature and synonymy, type species data, comparative diagnosis, detailed redescription of known species and description of new species, geographic variation and distribution, locality data from selective study specimens, habitat preference and associated species, and closely related species from adjoining biogeographic regions.

A new subgenus, *Cicindela* (*Glomera*), is established for *Cicindela belloides* (Horn, 1907), new combination, formerly in the genus *Prothyma* Hope, 1838; the new species *Cicindela* (*Glomera*) *ochrocnemis* is described.

Seventeen new species of subgenus *Cicindela* (*Jansenia*) are described: *dasiodes*; *semisetigerosa*; *vestiplicatica*; *legnotia*; *plagatima*; *ostrina*; *corrugatos*; *cratera*; *cirrhidia*; *stellata*; *choriodista*; *psarodea*; *rostrulla*; *fusissima*; *sandurica*; *reticulella*; *applanata*. Six new species of subgenus *Cicindela* (*Ifasina*) are described: *cyclobregma*; *collicia*; *melitops*; *paucipilina*; *limitisca*; *anelia*. The new species *Cicindela* (*Eugrapha*) *ancistridia* is described.

The following new subspecies are described: *Cicindela* (*Cosmodela*) *intermedia chitwanae*; *Cicindela* (*Lophyridia*) *plumigera macrograptina*; *Cicindela* (*Ifasina*) *umbropolita lucidinigrosa*.

New names are proposed for the following: *Cicindela* (*Cosmodela*) *aurulenta juxtata* for *aurulenta flavomaculata* Chevrolat, 1845, preoccupied by *flavomaculata* Hope, 1831; *Cicindela* (*Lophyridia*) *catena insularisca* for *catena insularis* Naviaux, 1984, preoccupied by *insularis* Blanchard, 1853; *Cicindela* (*Lophyridia*) *cancellata intemperata* for *cancellata viridula* Mandl, 1982, preoccupied by *viridula* Quenzel, 1806.

The following *Cicindela* (*sensu lato*) are elevated to species rank within these subgenera: *C. (Ancylia) diversa* Horn, 1924; *C. (Lophyridia) fowleri* Heynes-Wood and Dover, 1928; *C. (Lophyridia) plumigera* Horn, 1892; *C. (Jansenia) laeticolor* Horn, 1904; *C. (Jansenia) stuprata* Horn, 1909; *C. (Ifasina) labioaenea* Horn, 1892; *C. (Ifasina) fallaciosa* Horn, 1897; *C. (Ifasina) severini* Horn, 1892; *C. (Ifasina) subtilesignata* Mandl, 1970; *C. (Ifasina) modica* Gestro, 1893; *C. (Ifasina) sikhimensis* Mandl, 1982; *C. (Eugrapha) brevis* Horn, 1905; *C. (Eugrapha) iravaddica* Gestro, 1893; *C. (Eugrapha) biprolongata* Horn, 1924; *C. (Eugrapha) procera*, Horn, 1905; *C. (Myriochile) dubia* Horn, 1892.

Based on our examination of type material, the following names are given species rank: *Cicindela* (*Calochroa*) *flavomaculata* Hope, 1831 (= *sempunctata* auctorum, nec Fabricius, 1775); *Cicindela* (*Lophyridia*) *angulata* Fabricius, 1798 (= *sumatrensis* Herbst, 1806); *Cicindela* (*Ifasina*) *viduata* Fabricius, 1801 (= *triguttata* Herbst, 1806).

New combinations are proposed: *Cicindela bicolor xanthospilota* Fowler, 1912, formerly *C. haemorrhoidalis xanthospilota* Fowler, 1912; *Cicindela labioaenea fuscocuprascens* Horn, 1905, formerly *Cicindela viridilabris fuscocuprascens* Horn, 1905.

Synonyms are proposed for these subgenera of *Cicindela* (*sensu lato*): *Rivaliera* Pajni and Bedi, 1974, under *Chaetodera* Jeannel, 1946; *Pseudochaetodera* Pajni and Bedi, 1974, under *Chaetodera* Jeannel, 1946.

The following *Cicindela* (*sensu lato*) species and subspecies synonymies are proposed within these subgenera: *C. (Sophiodela) dejeanii* Hope, 1831, under *C. (Sophiodela) cyanea* Fabricius, 1787; *C. (Pancallia) aurofasciata latifasciata* Mandl, 1957, under *C. (Pancallia) aurofasciata goryi* Chaudoir, 1852; *C. (Ancylia) unica* Fleutiaux, 1895, *C. (Ancylia) andrewesi mauritii* Horn, 1907, and *C. (Ancylia) ceylonensis atricolor* Mandl, 1981, under *C. (Ancylia) andrewesi* (Horn, 1894); *C. (Ancylia) calligramma confluent* Fowler, 1912, under *C. (Ancylia) calligramma* Schaum, 1861; *C. (Calochroa) aurovittata* Audouin and Brullé, 1839, under *C. (Calochroa) sexpunctata* Fabricius, 1775; *C. (Cosmodela) ferriei kasyi* Mandl, 1967, and *C. (Cosmodela) intermedia kasyi* Mandl, 1981, under *C. (Cosmodela) intermedia* Chaudoir, 1852; *C. (Cosmodela) loeffleri* Mandl, 1970, and *C. (Cosmodela) fleutiauxi loeffleri*

Mandl, 1975, under *C. (Cosmodela) fleutiauxi* Horn, 1915; *C. (Lophyridia) sumatrensis* Herbst, 1806, and *C. (Lophyridia) renardi* Fleutiaux, 1890, under *C. (Lophyridia) angulata* Fabricius, 1798; *C. (Lophyridia) sumatrensis imperfectula* Horn, 1938, under *C. (Lophyridia) fowleri* Heynes-Wood and Dover, 1928; *C. (Ifasina) triguttata* Herbst, 1806, and *C. (I.) chlorochila* Chadoir, 1852, under *C. (Ifasina) viduata* Fabricius, 1801; *C. (Ifasina) nathanae* Mandl and Wiesner, 1975, under *C. (Ifasina) severini* Horn, 1892; *C. (Ifasina) obscuridilatata* Horn, 1914, under *C. (Ifasina) decempunctata* Dejean, 1825; *C. (Eugrapha) venosa atroptera* Mandl, 1963, under *C. (Eugrapha) venosa* Kollar, 1836; *C. (Lophyridia) funerea eberti* Mandl, 1965, under *C. (Eriodera) albopunctata* Chadoir, 1852; *C. (Myriochile) melancholica nepalensis* Mandl, 1965, under *C. (Myriochile) atelesta* Chadoir, 1854; *C. (Hypaetha) millingeni* Bates, 1878, and *C. (Hypaetha) renei* Horn, 1897, under *C. (Hypaetha) quadrilineata* Fabricius, 1781.

## INTRODUCTION

The Indian subcontinent tiger beetles of genus *Cicindela* (*sensu lato*) have held considerable interest for us during the past two decades. They represent a unique fauna, rich in endemics, which has been studied only superficially. Some components of the fauna have been known for over 200 years; many more were described at the turn of the century. Despite their popularity among insect dealers and collectors, much of the tiger beetle fauna on the Indian subcontinent remained uncollected until only recently.

Within the last 18 years, many specimens became available to the first author through purchases by himself and The Carnegie Museum of Natural History of tiger beetles collected by Mrs. Theresa R. S. Nathan in Tamil Nadu, India, and adjacent states. During the last seven summers, the second author collected extensively throughout India and Nepal as part of his ecological research with tiger beetles. As a result, a great deal of recently collected tiger beetles with reliable locality and habitat data become available to us for study.

The main reference for identifying Indian subcontinent tiger beetles has been Fowler (1912), supplemented by Horn (1915, 1938) and Rivalier (1961). Unfortunately, none of these publications adequately treat all of the species or subspecies now known to occur in India and adjacent countries. New species have been described from these countries since the two earliest references; there have been changes in the nomenclatural status for many species already described; and many undescribed species have turned up in the recent collections mentioned earlier. Furthermore, confusion existed about the correct identities and names to apply to several of the more commonly encountered species, and the obscure species were determined only with great uncertainty. A thorough review of the Indian subcontinent *Cicindela* (*sensu lato*) tiger beetles seemed not only appropriate but highly desirable to understand this diverse fauna.

Our goal is to examine comprehensively *Cicindela* (*sensu lato*) on the entire Indian subcontinent and present the species in enough detail for their unambiguous recognition, while at the same time stabilizing their nomenclature and establishing their classification on a firmer basis. A comprehensive review, therefore, needs to include updates of classification based on relevant sexual and nonsexual characters, identification through keys and comparative diagnoses and descriptions, geographic distribution and selected locality data, seasonal occurrence, habitat preference and ecological relationships.

A review of *Cicindela* (*sensu lato*) species and subspecies logically starts with published information about the genus on the Indian subcontinent. The earliest such information is found in catalogues that simply list the species (Schaum, 1863; Atkinson, 1889; Horn, 1905*b*). Annandale and Horn (1909) provided an anno-

tated listing of the species found in the Indian Museum, Calcutta, accompanied by data on geographic distribution and habits. Fowler (1912) compiled the first comprehensive treatment for all the genera of tiger beetles on the Indian subcontinent. Horn (1915) also treated all the genera comprehensively, but from a worldwide perspective. Three catalogues (Dover and Ribeiro, 1923; Horn, 1926; Heynes-Wood and Dover, 1928) brought together much information on the synonymy, type depository, and geographic distribution of the species and subspecies. Horn (1938) provided a means of identifying species and subspecies using illustrations of elytral patterns, and Rivalier (1950, 1958, 1961, 1971) developed a classification using male genitalic characters.

There have been many surveys published based on specimens obtained from local and regional collecting. Fleutiaux (1899) presented collection records from Karachi, Pakistan. Horn (1904) published data on specimens he had seen from the Colombo Museum or personally collected in Sri Lanka. Dover and Ribeiro (1921) reported on collecting in Assam and Darjeeling District, West Bengal. Usman and Puttarudraiah (1955) presented locality information from Karnataka, and Mani et al. (1955) from the Punjab. Pajni and Bedi (1973) and Pajni et al. (1984) surveyed the tiger beetles of the Chandigarh area, Punjab, India. Mandl (1963, 1975) reported on the results of expeditions to the upper headwaters of the Indus River in Kashmir, India, and Bhutan. Wiesner (1975) presented collection data, localities and habitats for ten species taken on a journey through Nepal, India and Sri Lanka, as did Maser (1975) for Nepal. Ghulam-Ullah and associates (1966, 1970) provided survey results from the vicinities of Quetta and Kohat and the regions of Hazara and Swat, Pakistan, and Chittagong and the Chittagong Hill Tracts, Bangladesh. Cassola (1976) presented the results of recent collecting at Karachi and Lahore, Pakistan. Pearson and Ghorpade (1987) surveyed the tiger beetles of the Siliguri-Darjeeling area of West Bengal, India. Naviaux (1984*b*, 1985, 1986) prepared important faunistic studies based on the tiger beetles he and his colleagues personally collected in Sri Lanka and Nepal. A summary of the Nepal species was presented by Acciavatti (1987) mostly based on recent collections.

As valuable as these surveys have been, they represent a superficial and incomplete treatment of the entire Indian subcontinent *Cicindela* (*sensu lato*) fauna. Treating the entire fauna requires careful field observations in each of the diverse ecological and climatic regions of the Indian subcontinent. During May to July from 1982 through 1988, the second author of this paper personally observed and collected tiger beetles throughout India. The specimens collected during these trips formed the majority of the material available for taxonomic study, and provided the detailed records of habitat and geographic distribution for most of the species and subspecies required for this comprehensive review. Biogeographical information for India (Mani, 1974) and for tiger beetles of the Indian subcontinent (Pearson and Ghorpade, 1989) are published elsewhere.

The present paper is organized into several sections: 1) an explanation of many of the characters used to identify *Cicindela* (*sensu lato*); 2) a key to distinguish *Cicindela* (*sensu lato*) from related genera within the tribe Cicindelini, subtribe Cicindelina, occurring on the Indian subcontinent; 3) a key to the subgenera of *Cicindela* (*sensu lato*) that relies on external morphological characters (easily seen with magnification of 40× or less) supplemented by male genitalic characters; 4) a separate treatment of each subgenus, including synonymy, diagnostic characters, checklist of included species, and key to species; 5) a detailed account of each species or subspecies in the subgenus reported from the Indian subcontinent

including the following—data about the type specimens including lectotype designation if appropriate; synonymies and nomenclatural notes as appropriate; comparative diagnosis for distinguishing the taxon within its subgenus; detailed re-description of previously known species emphasizing important external body and male aedeagal characters not included in the original description; descriptions and habitus illustrations of new species and descriptions of new subspecies discovered during this research; geographic distribution tied into a range map; selective label data from examined specimens; ecological observations about habitat preference, behavior and associated species; brief comparison with related species from the Oriental and Palearctic biogeographic regions when applicable.

## METHODS

### *Museum and Collection Study Material*

Adult specimens of all previously described species and subspecies were examined, including numerous holotypes, paratypes and syntypes. Original descriptions for each species and subspecies known from the Indian subcontinent and most pertinent systematics literature were obtained for study and comparison with adults. Specimens for examination and information about types came from these museums:

- AMNH American Museum of Natural History, New York, New York, U.S.A.;
- ANIC Australian National Insect Collection, Canberra, Australia;
- BMNH British Museum (Natural History), London, England;
- BPBM Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A.;
- CASS California Academy of Sciences, San Francisco, California, U.S.A.;
- CMNH Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, U.S.A.;
- CNCO Canadian National Collection, Ottawa, Canada;
- CUI Cornell University, Ithaca, New York, U.S.A.;
- DEI Institut für Pflanzenschutzforschung Kleinmachow der Akademie der Landwirtschaftswissenschaften (formerly Deutsche Entomologische Institut), Eberswalde, G.D.R.;
- FCAG Florida Collection of Arthropods, Gainesville, Florida, U.S.A.;
- FRI Forestry Research Institute, Dehra Dun, India;
- HMO Hope Museum, Oxford, England;
- IARI Indian Agricultural Research Institute, New Delhi, India;
- IRSNB Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium;
- ITZA Instituut voor Taxonomische Zoologie, Amsterdam, The Netherlands;
- MCSNG Museo Civico di Storia Naturale, Genoa, Italy;
- MCZC Museum of Comparative Zoology, Cambridge, Massachusetts, U.S.A.;
- MHNG Muséum d'Histoire Naturelle, Geneva, Switzerland;
- MNHB Museum für Naturkunde der Humboldt-Universität zu Berlin, G.D.R.;
- MNHNP Muséum National d'Histoire Naturelle, Paris, France;
- MSU Michigan State University, East Lansing, Michigan, U.S.A.;
- NMNH United States National Museum of Natural History, Washington, D.C., U.S.A.;
- NMP National Museum, Prague, Czechoslovakia;
- NMV Naturhistorisches Museum, Vienna, Austria;
- NRMS Naturhistoriska Riksmuseum, Stockholm, Sweden;
- SMFM Senckenburg Museum, Frankfurt am Main, F.R.G.;
- SMTD Staatliches Museum für Tierkunde, Dresden, G.D.R.;
- UMDE University of Minnesota, Department of Entomology, St. Paul, Minnesota, U.S.A.;
- UMMZ University of Michigan, Museum of Zoology, Ann Arbor, Michigan, U.S.A.;
- UASB University of Agricultural Science, Bangalore, India;
- UASC University of Agricultural Science, Coimbatore, India;
- ZIL Zoological Institute, Lund University, Lund, Sweden;
- ZISL Zoological Institute, Academy of Sciences of the U.S.S.R., Leningrad, U.S.S.R.;
- ZMH Zoologisches Museum, Hamburg, F.R.G.;
- ZMMU Zoological Museum, Moscow University, Moscow, U.S.S.R.;
- ZMUC Zoologisk Museum, Universitetsparken, Copenhagen, Denmark;
- ZSBS Zoologische Sammlung des Bayerischen Staates, Munich, F.R.G.;
- ZSI Zoological Survey of India, Calcutta, India.

The following private collectors provided us with material for study, assisted us with various details of our research, and maintain the depositories for many of the type specimens described in this review: Howard Boyd, Vincentown, New Jersey, U.S.A. (HBC); Fabio Cassola, Rome, Italy (FCC); Robert Davidson, Pittsburgh, Pennsylvania, U.S.A. (RDC); Ed Gage, San Antonio, Texas, U.S.A. (EGC); John Glaser, Baltimore, Maryland, U.S.A. (JGC); Ronald L. Huber, Prairie Village, Kansas, U.S.A. (RLHC); Robert Murray, Fort Worth, Texas (RMC); Roger Naviaux, Domerat, France (RNC); Chris Br. van Nidek, Voorburg, The Netherlands (CVNC); David Pearson, Tempe, Arizona, U.S.A. (DLPC); Johann Probst, Vienna, Austria (JPC); Hirofumi Sawada, Aomori, Japan (HSC); John Stamatov, Armonk, New York, U.S.A. (JSC); W. D. Sumlin, San Antonio, Texas, U.S.A. (WDSC); Kenneth W. Vick, Gainesville, Florida, U.S.A. (KWVC); Robert D. Ward, Burke, Virginia, U.S.A. (RDWC); Karl Werner, Peiting, F.R.G. (KWC); Jürgen Wiesner, Wolfsburg, F.R.G. (JWC). The first author's collection has been deposited at CMNH.

### *Type Material*

Name-bearing type specimens provide the reference standard for zoological nomenclature at the species rank by fixing a name to a biological concept. We have been able to find and examine name-bearing types of a great many of the Indian subcontinent *Cicindela* (*sensu lato*) species and subspecies. The location of these type specimens was determined by using Horn and Kahle (1935–1937), then contacting the appropriate museum for verification and initiation of a loan request.

Pertinent information we obtained about the name-bearing type specimens, e.g. holotype, lectotype, syntype, is presented under "Type status" accompanying each species or subspecies account. Lectotype and paralectotype designations by the first author have been made for many species and subspecies because no holotype has ever been designated. Types and certain other specimens which we have personally examined are marked with an exclamation point (!) throughout this review. Examined holotypes are indicated and, in certain cases, their label data are presented. Unexamined syntypic specimens in museums have been stated when documented in publications or in correspondence detailing museum holdings. For taxa not available to us, suspected syntypic specimens have been noted with a question mark (?). When we were not able to examine name-bearing type specimens, we have indicated the specimen(s) forming our concept of that species or subspecies. "Type labels" presents actual label data arranged from top to bottom on the insect pin; each label separated by a semicolon, each side of a label by a slash, and each line separated by a comma with the labelling in quotes followed by the label format (i.e. writing style, size, shape, color) in brackets. Lectotype size and any external characteristics useful in its recognition have been noted. The type depository, presented under "Type depository" in the species accounts, is stated by using the abbreviations for the museums or private collections presented in the previous section. The type locality, presented in the species account under "Type locality" for each valid species or subspecies, is quoted directly from the original description with clarification as to the currently understood or accepted locality name presented in parentheses.

### *Nomenclature*

The guiding rules and recommendations pertaining to taxonomic names are presented in the third edition of the International Code of Zoological Nomenclature (herein referred to as "the Code") published by the International Commission on Zoological Nomenclature (herein referenced as ICZN, 1985). Synonyms, homonyms and pertinent nomenclatural works that we consider valid in naming a subgenus, species or subspecies, follow the taxon name in each species account.

Some species or subspecies names in this review differ from those published. The reasons for these differences, along with any other pertinent remarks on the nomenclature of a taxon, are presented in the "Nomenclatural note" section accompanying certain species or subspecies accounts. These differences are based primarily on our study of name-bearing types but also involve a thorough literature review and incorporate recently published information.

In the "Remarks" section for certain species accounts we present the morphological basis for any proposed changes in species rank and provide comparative diagnostic characters for separating closely related species. These changes also are based on our critical study of specimens including the available types of each species or subspecies.

### EXTERNAL CHARACTERS

Within each species account, we have referenced publications which illustrate the species, such as Fowler (1912), Horn (1938) and Naviaux (1984*b*, 1985, 1986,



1987); the latter presented excellent line drawings of the habitus, labrum and aedeagus of a large number of the species and subspecies.

For adults of each species, external morphological characters of chaetotaxy, surface texture, coloration, elytral pattern, shape and size of certain selected sclerites and appendages were observed, measured and catalogued. These are presented as diagnostic characters used to distinguish a taxon from closely related species or subspecies, to support our elevation of a taxon to species rank and to establish a new species or subspecies. A description of external characters seen with 40× or less magnification has been organized by major adult body regions to permit easy comparison among species. The external appearance of the male genitalia has been included in the description as it is often diagnostic in separating closely related species. Any major morphological variation observed throughout the geographic distribution of a species is presented.

Horn (1915) was the first to recognize and make general use of adult body setae in classifying *Cicindela* (*sensu lato*). More recently, Willis (1968) and Freitag (1979) have used setal characters in their faunal treatments of *Cicindela* (*sensu lato*) of North America (north of Mexico) and of Australia, respectively.

Almost all the external characters presented in the couplets of the keys of this review and in the species accounts are based on recognizing the selected sclerites and appendages common to all Coleoptera. Most characters are self-evident from the couplet statements; however, the following characters particular to tiger beetles require a more complete explanation:

*Body chaetotaxy.*—Setal types and patterns provide the most useful characters for distinguishing species and are used extensively in the keys. The following types of setae can be recognized on the adult body and its appendages: 1) Primary. Long, thin setae, sensory in purpose, originating from large setigerous punctures. They occur singly or in small groups on the trochanters, labrum, antennal scape, vertex of the head, proepisternum, pterothoracic sclerites, and abdomen of most species. The antennal scape of all species has at least one primary seta near its distal end but adults of some species may possess one to a few normal setae (discussed below) proximal to the primary seta(e). For adults of all species, the vertex of the head has two pairs of single (double on a few specimens) supraorbital setae; one pair at the front of the eyes, the other near the middle. Adults of a few species possess two paired groupings of multiple supraorbital setae. We consider the vertex "glabrous" when it possesses only supraorbital setae; for all other cases, the presence of some type of normal setae (discussed below) is mentioned in the species descriptions. 2) Hairs. Short, very fine often indistinct setae originate from minute, scarcely visible pits on the abdominal sternites, prosternum and genae of certain species. Although these first two setal types are sometimes rubbed off study specimens, the occurrence of dimple-like pits attest to their former presence. 3) Normal. Moderately wide and long setae are the most common type of pubescence of *Cicindela* (*sensu lato*). They originate from small or large setigerous punctures as either "erect," "semierect," or "appressed" setae and occur in fairly dense concentrations on many body sclerites and appendages. Specimens which have become wet in collecting jars, or which remain coated with body secretions, often appear to have appressed setae when in fact the setae are erect. The body appendages and surfaces on adults of most species have straight erect setae but the femora on adults of certain species have setae bent into hooks. 4) Decumbent. Noticeably thick, white setae which are relatively wider than erect or appressed setae, often are oriented in one direction and in most specimens are so dense as



to obscure the body surface. The distinction can be made between decumbent and the other setal types regardless of the specimen's condition. 5) Bristle. The fourth proximal antennomere on males of certain species has a bundle of thickened, erect bristle-like setae which may have clubbed ends. We refer to this structure as a "penicillum" after Cassola (1980) who proposed that males may stimulate females with it during mating.

*Labrum*.—The dimensions of the labrum (excluding teeth) can be translated into three relative measures of length: 1) Long. Longitudinal dimension exceeds one-half of the transverse dimension. 2) Short. Longitudinal dimension equals one-half of the transverse dimension. 3) Very short. Longitudinal dimension is less than one-half the transverse dimension. The number of teeth, or the absence of certain ones, while constant in adults of a species, can differ by sex and age of the specimen due to wear; therefore, as many specimens of each sex as possible should be examined. Rounded bulges are not considered teeth, but acute projections should be so considered. Teeth occur most frequently along the anterior margin of the labrum, but a long, oblique labrum may possess teeth along each lateral margin. Other diagnostic labral characters include the number of primary setae and their position relative to the margin; the upper surface color or texture in the case of metallic or nonmetallic reflections; a carina or raised ridge at the midline.

*Coupling sulcus*.—Females are readily distinguished because they lack the dense setal pads on the proximal three anterior tarsomeres found on males. In addition, the sixth abdominal sternum of females is evenly rounded at the posterior margin but notched at the middle in males. The coupling sulcus is a groove, pit or cavity on the female mesepisterna that receives the mandibles of the male during copulation. Freitag (1974) described this secondary female mating structure and showed its importance in mate selection within a species. Kraus and Lederhouse (1983) further elucidated the function of the coupling sulcus as a means to foster insemination and prevent sperm displacement through contact guarding by riding males. The shape, depth, placement and orientation of the coupling sulcus is distinctive on females of most species and has been used extensively in our studies to differentiate closely related forms at the specific level, thereby providing an additional aid to species identification. Although a potentially important isolating mechanism for species, the coupling sulcus must generally be considered along with a suite of characters in this regard (Schultz, 1982).

*Elytral maculae*.—The elytral markings or maculae of *Cicindela* (*sensu lato*) have been the traditional characteristics for species and subspecies identification, and elytral maculae remain the most conspicuous structural feature used by taxonomists in this genus. Fig. 1 provides a generalization of the pattern and nomenclature of the maculae. The "standard" pattern of maculae, a convention developed as the basis for comparison, consists of humeral and apical lunules, and a middle band, any or all of which may be complete or divided into two or more separate segments, some or all narrowly joined. A sutural band and assorted other basal, lateral, medial and apical spots or small dots also may be present. The absence or fusion of certain maculae and the relative size, shape and pattern of those present, are discussed in the context of the standard pattern.

*Elytral surface*.—The elytral surface between the maculae is covered by several types of structures which provide useful diagnostic characters for separating some species: 1) Pits. For adults of most species, the elytral surface is covered by minute pits readily visible at 40 $\times$ . The pits reflect and refract light into different wave

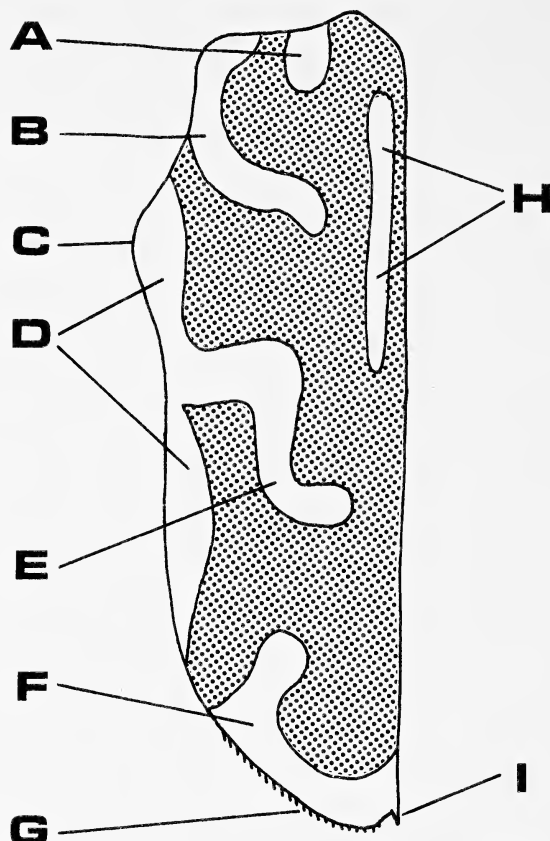


Fig. 1.—Generalized dorsal view of left elytron of *Cicindela* (*sensu lato*) depicting the standard pattern of maculae and structures used in the keys and descriptions: A, basal dot; B, humeral lunule; C, lateral expansion; D, marginal band; E, middle band; F, apical lunule; G, microserrulations; H, sutural band; I, apical spine [adapted and redrawn from Willis, 1968].

lengths depending on their structure and account in large part for the surface colors (Schultz and Rankin, 1985a, 1985b). Also, pit depth determines surface brightness; deep pits dull surfaces while shallow pits or absence of pits make surfaces shiny. Impunctate surfaces have only minute pits. Certain impunctate elytra under low magnification appear to be shallowly punctate because of contrasting colors. 2) Punctures. Large punctures on the elytra of most specimens are of varied depth over the surface. The color within the punctures often contrasts with that of the minute pits making the punctures more visible. 3) Granules. The elytral surface may be covered by these smooth, raised areas. If granules are scattered randomly over the surface, it is termed granulate. Alternatively, if they are associated with the punctures, the surface is termed “granulate-punctate.” The degree of punctation or granulation differs between the base and apex of the elytra. 4) Foveae. The largest type of puncture bearing hairs, though these may have been rubbed off. 5) Microserrulations. Row of small teeth along apical elytral margins.

*Body length.*—The length of the body is measured from the frons of the head to the elytral apex when the hypognathous head is in the normal feeding position.

Within the species and subspecies accounts, body length is categorized as: 1) Very small. Less than 8 mm; 2) Small. 8 to 10 mm; 3) Medium. 10 to 15 mm; 4) Large. 15 to 20 mm; 5) Very large. More than 20 mm.

#### INTERNAL CHARACTERS

The only internal characters presented in this review involve the male genitalia, which are comprised of the aedeagus and its inner sac, or intromittent organ. Fig. 2 illustrates the features of the aedeagus and structures of the inner sac. The terminology applied to these has been derived from Freitag et al. (1985).

The external appearance of the aedeagus, in terms of its size, shape and surface features, is described for males of each species examined. The relative width of the aedeagus and its taper are presented along with features such as its apical tip, apical orifice, supporting lateral flanges, and apical beak.

The complex of asymmetrical sclerites within the inner sac of the aedeagus is not discussed in any detail here except for the flagellum. The flagellum of each species was examined to confirm the generic and subgeneric groupings of species established by Rivalier (1961). The appearance of the flagellum, and, if needed, the associated stiffening rib and sustained membranes, have been described for each subgenus we discuss. Basing a classification in part on the flagellum appears to be relevant because this structure performs an important function in reproduction. During mating, the flagellum fits into the female spermathecal duct thereby preparing it for sperm transfer to the female bursa copulatrix (Freitag et al., 1985).

Some explanation is needed about the names to be applied to the different outer surfaces of the aedeagus and how the internal position of the flagellum relates to them because several different interpretations have been presented in the literature. We use the interpretation of Freitag et al. (1985) in which the surface names are based upon the aedeagus positioned externally during mating. For study specimens, however, the aedeagus most often lies within the abdominal cavity before it is removed for examination. In this internal position, its basal orifice points to the right and its broad left lateral aspect faces dorsally. In live adults, while being extended from the internal resting position prior to mating, the aedeagus rotates counterclockwise 90° when viewed from the rear of the body, and changes direction by 180° to achieve the anteriorly oriented external mating position. Rivalier (1961) referenced the orientation of the internal sclerites, especially the flagellum, with respect to the aedeagus as if it were externally extended for mating and viewed from the rear of the body. However, he illustrated the aedeagus in the manner which we use here. Thus, his left side conforms to our left lateral aspect, and his right side to our right lateral aspect. The inner sac, however, is most often illustrated as though the aedeagus remained within the abdominal cavity.

#### DISTRIBUTION AND ECOLOGY

The known distribution for each species or subspecies is described and figured (Fig. 36–63) within the political boundaries of the Indian subcontinent (Fig. 35; Government of India, 1965, 1980; Spate, 1954). References should be made to these distributions to help confirm the identify of a specimen under study. The locality data came from: 1) published records of Heynes-Wood and Dover (1928); 2) additions or corrections by more recent authors listed earlier in the introduction as well as from our present study; 3) label data from examined specimens; and 4) field collections by the second author. Each species account includes a listing

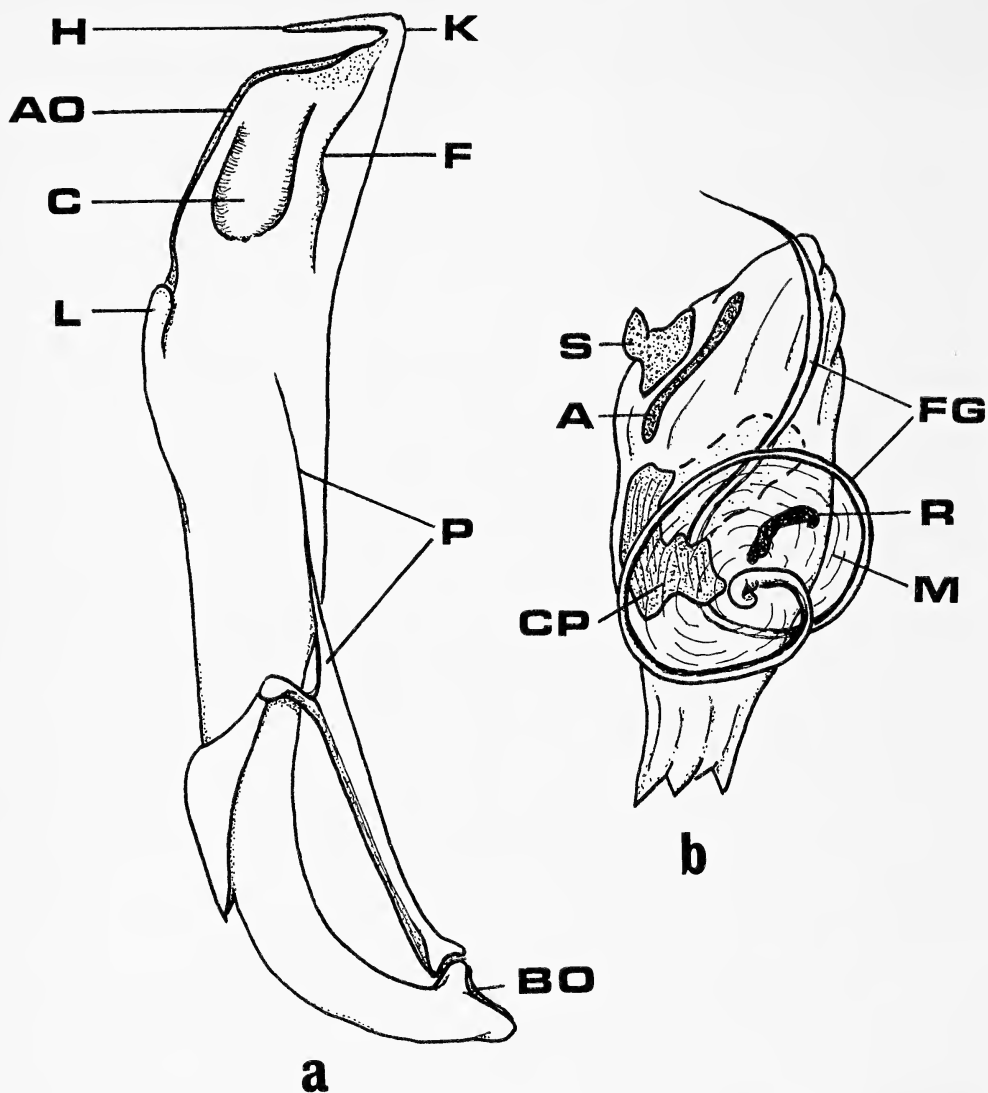


Fig. 2.—Generalized male genitalia of *Cicindela* (*sensu lato*) depicting features used in the keys and descriptions. a. Left lateral aspect of aedeagus—AO, apical orifice; BO, basal orifice; C, concavity; F, lateral apical flange; H, apical hook; K, beak; L, basal lobe; P, paramere. b. Dorsal aspect of inner sac—A, arciform piece; CP, central plate; FG, flagellum; M, sustained membrane; R, stiffening rib; S, shield [adapted and redrawn from Freitag et al., 1985].

of selected localities based on the most complete collection data available from specimens we examined and supplemented by recent reliable published records if these contributed significant distribution and ecological data.

Short descriptions of the habitat for each species and regularly associated tiger beetle species observed by the second author or published by others from recent field observations are included in the account accompanying each species. During the height of the monsoon season, many species regularly move from their preferred habitats and occur over a much wider range of habitat types.

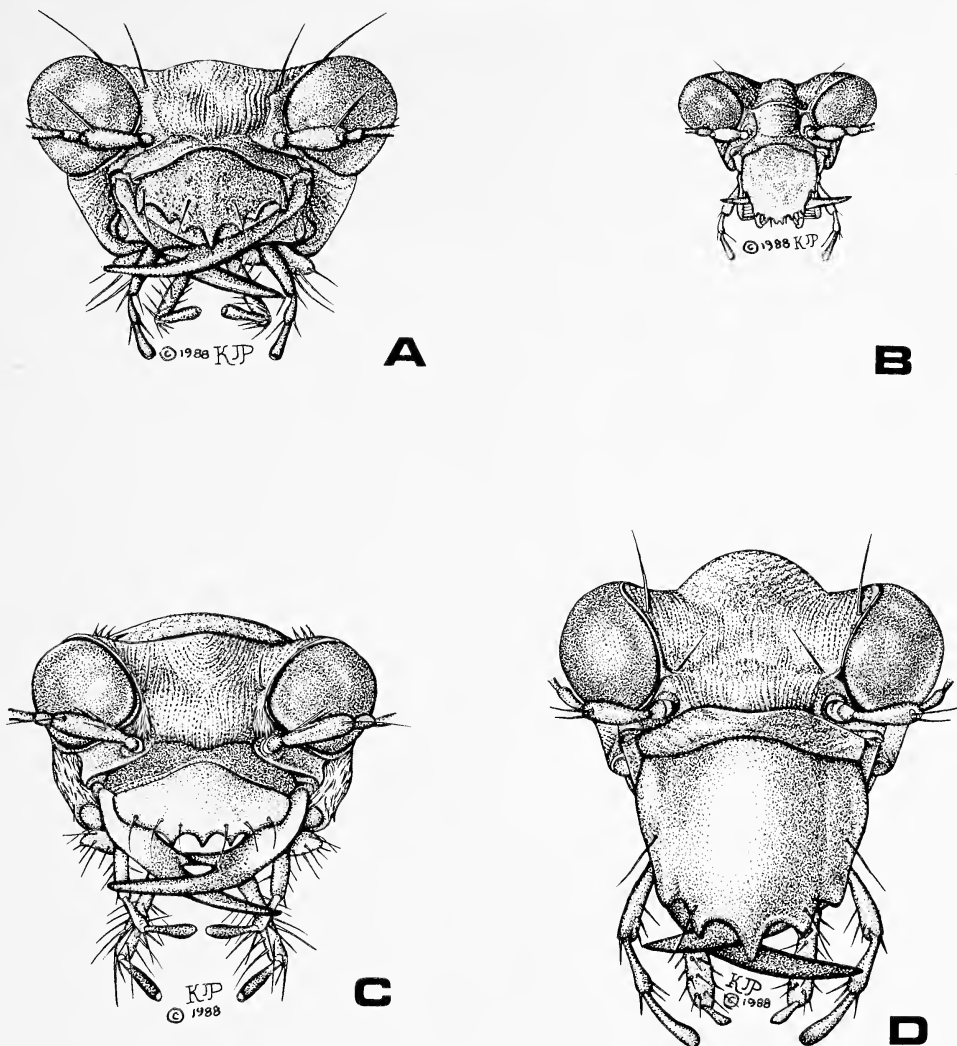


Fig. 3.—Heads of four Cicindelini genera in anterior view: A, *Prothyma*; B, *Therates*; C, *Cicindela*; D, *Heptodonta*.

#### SYSTEMATICS

##### Key to adults of Indian subcontinent Cicindelini genera

On the Indian subcontinent, certain other Cicindelidae species superficially resemble *Cicindela* (*sensu lato*) tiger beetles. Together with *Cicindela* (*sensu lato*) Linnaeus, 1758, these other species are grouped within the tribe Cicindelini Sloane, 1906, subtribe Cicindelina Horn, 1908, and represent the related genera *Therates* Latreille, 1817, *Prothyma* Hope, 1838, *Rhytidophaena* Bates, 1891, *Heptodonta* Hope, 1838, and *Apteroessa* Hope, 1838. The following key, adapted in part from Willis (1969) and Rivalier (1971), together with the accompanying illustrations, permit the separation of species on the Indian subcontinent belonging to these six genera within the Cicindelini, Cicindelina:

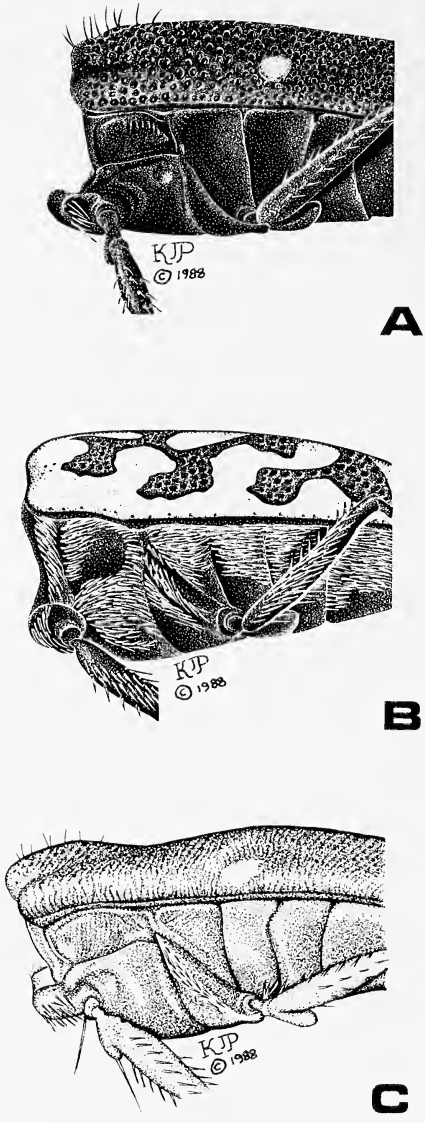


Fig. 4.—Pterothoraces and anterior abdominal sterna of three Cicindelini genera in left lateral view: A, *Prothyma*; B, *Cicindela*; C, *Heptodonta*.

- 1. Galea of maxilla reduced to a one-segmented process; fourth tarsomere short with fifth segment inserted toward middle of its upper side; labrum elongate, almost completely covering the closed mandibles; labral setae originating at anterior margin (Fig. 3B) ..... *Therates* Latreille (Fig. 5)
- Galea of maxilla normal in length and two-segmented; fourth tarsomere not shortened with fifth segment inserted apically; labrum variable in length, not completely covering the closed mandibles, labral setae on adults of most species originating submarginally (Fig. 3A, 3C, 3D) . . . . . 2

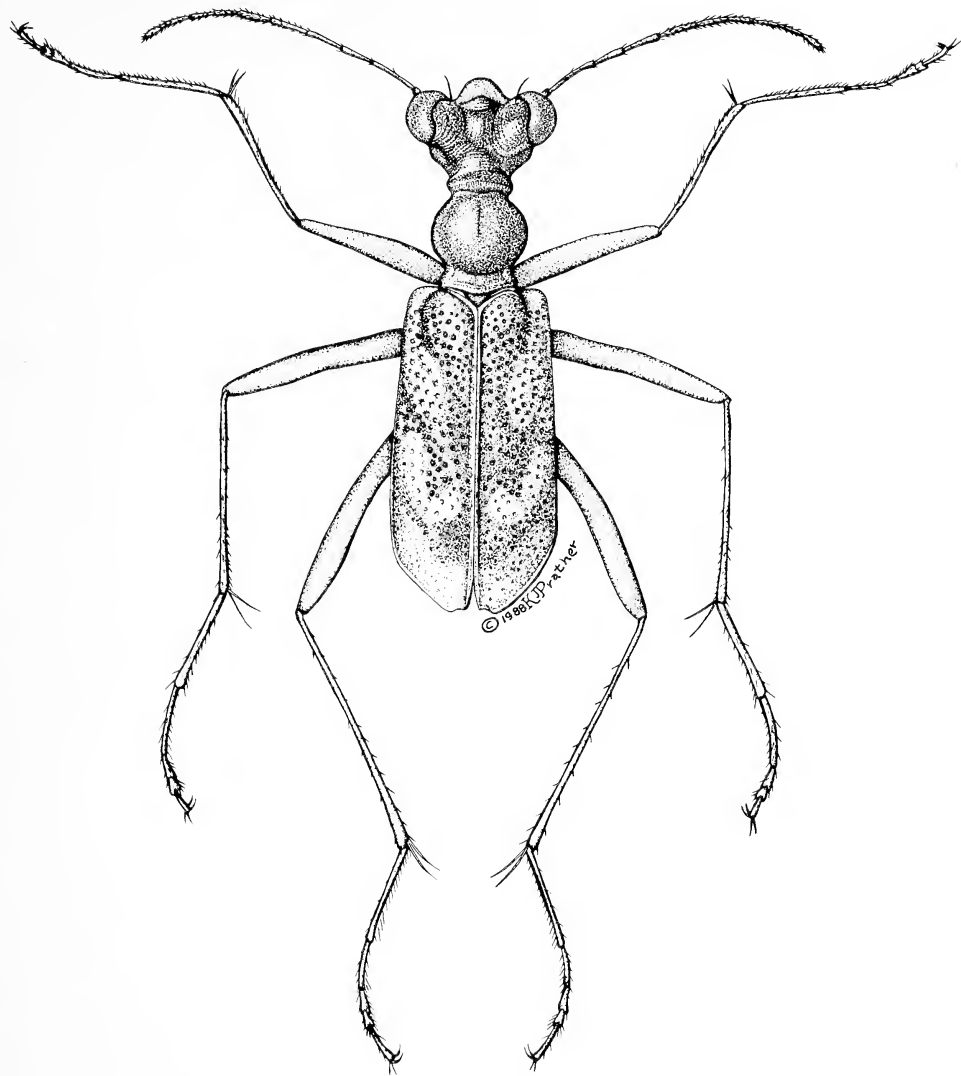


Fig. 5.—*Therates mandli* Probst, male from Godavari, Kathmandu, Nepal. (Body size, 8.0 mm.)

- 2.(1.) Small pits on vertex of head, anterior margin of pronotum and genae; hind margins of mesepisterna swollen and laterally surpassing front margin of mesepimera; mesepimera with a process somewhat overlapping the lateral anterior corner of the metepisternum ..... *Apteroessa* Hope
- Slightly pitted vertex of adult head for a few species, adults of most species lack pits at anterior margin of pronotum and on genae; hind margins of mesepisterna not swollen, not laterally surpassing the front margin of the mesepimera; mesepimera without a lateral process ... 3
- 3.(2.) Head, thoracic pleura and sterna, abdominal segments or base of elytra setose (Fig. 4B); whitish sutural or discal maculae on posterior one-

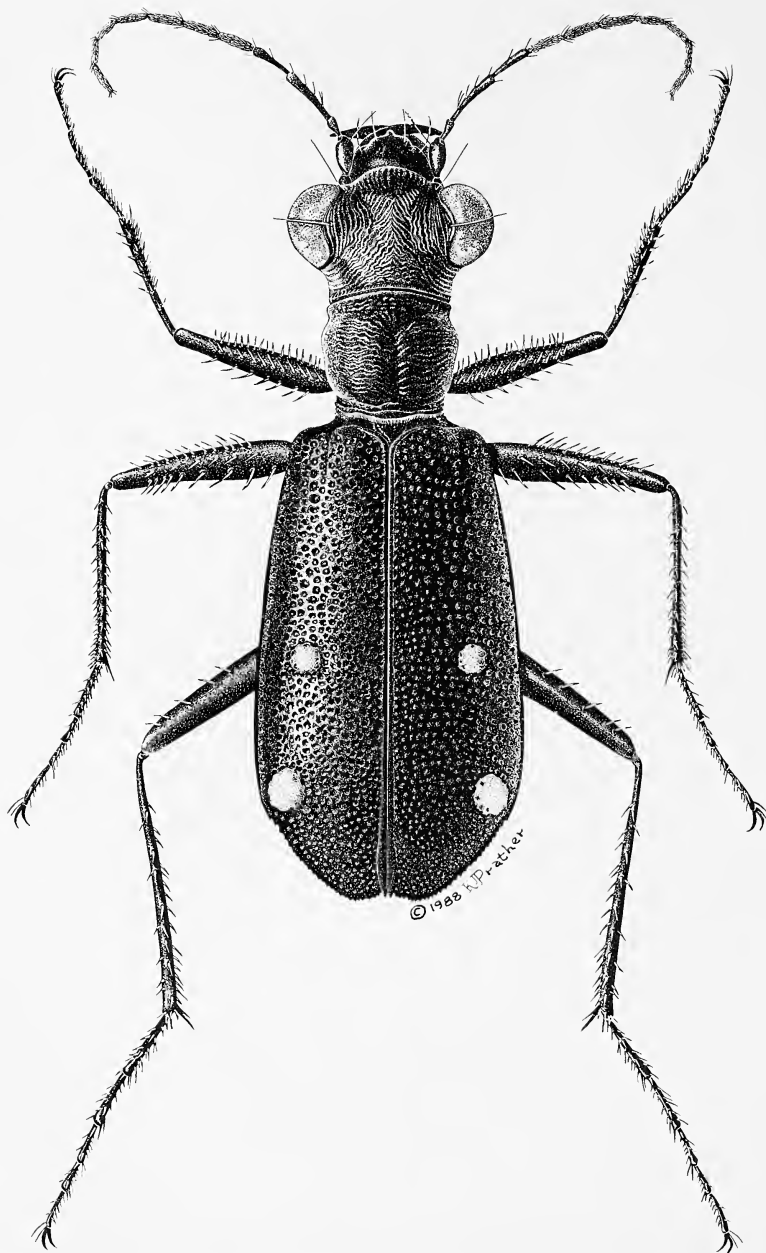


Fig. 6.—*Prothyma proxima* Chaudoir, female from Coimbatore, Tamil Nadu, India. (Body size, 9.5 mm.)

- third of elytra on adults of most species .....  
 ..... *Cicindela (sensu lato)* Linnaeus (Fig. 7)  
 – Head, thoracic pleura and sterna, abdominal segments and elytra gla-  
 brous (Fig. 4A, 4C); whitish sutural or discal markings or maculae  
 absent from posterior one-third of the elytra ..... 4



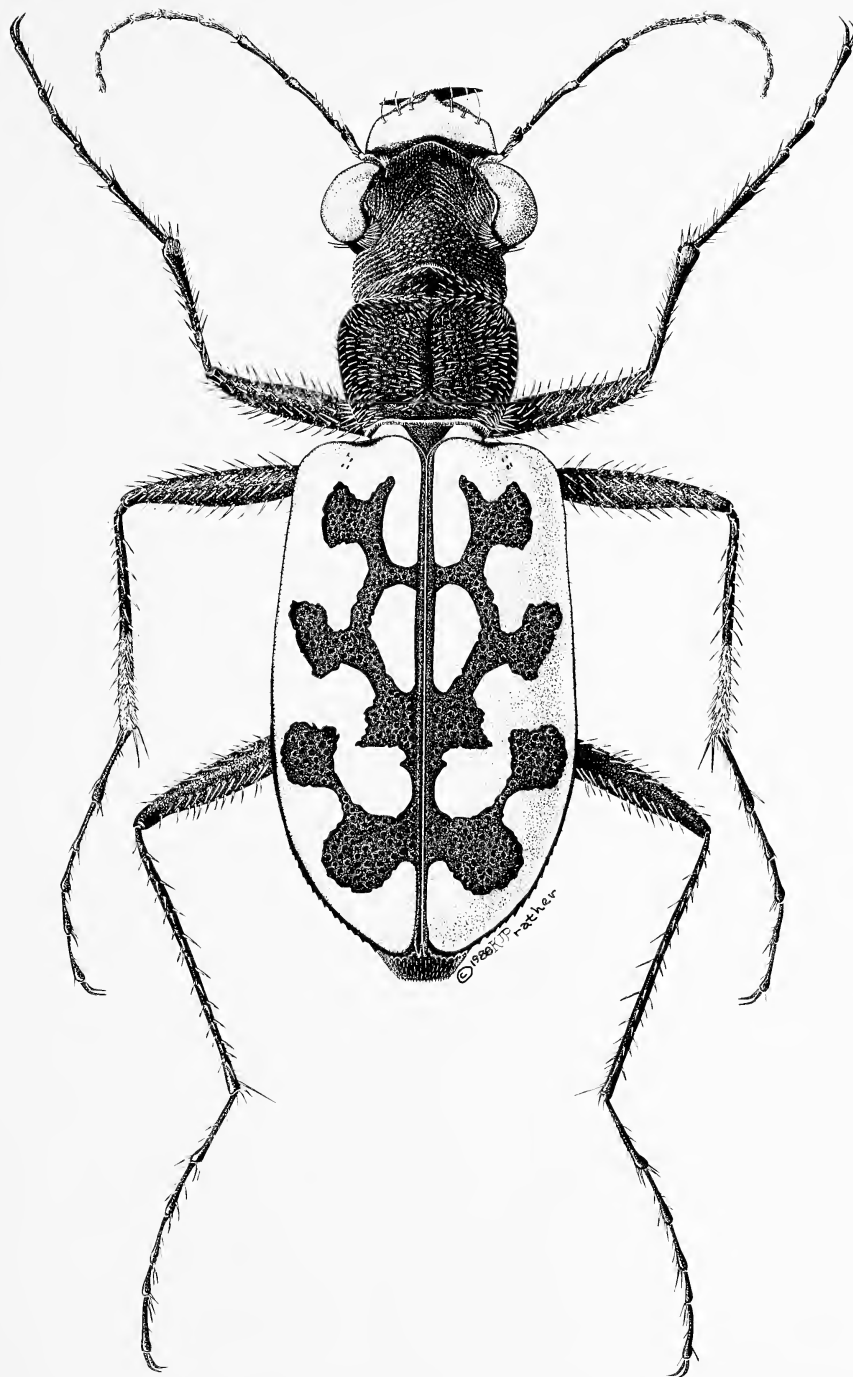


Fig. 7.—*Cicindela (Lophyra) catena* Fabricius, female from Kondachchi, Mannar District, Sri Lanka. (Body size, 10.5 mm.)

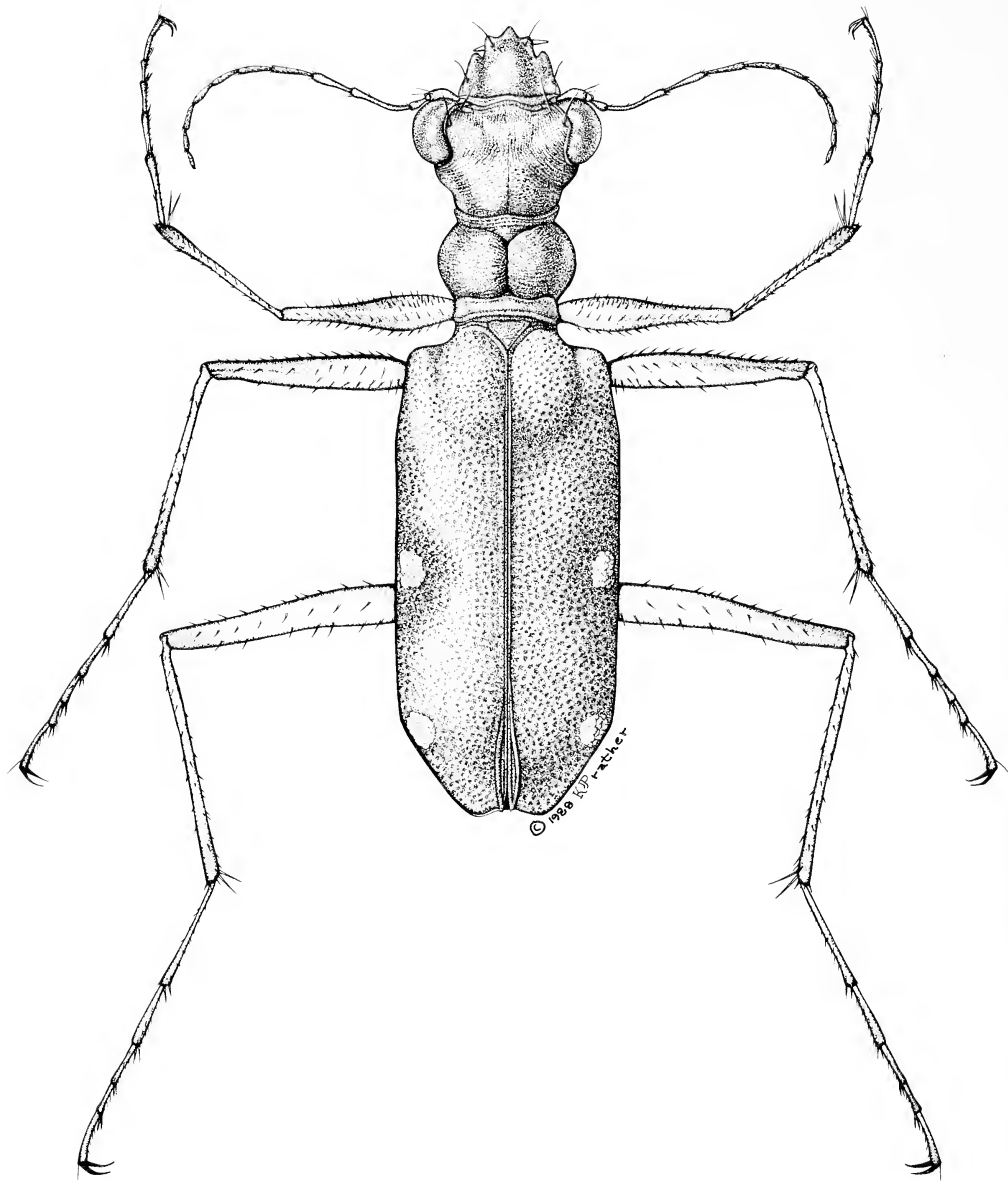


Fig. 8.—*Heptodonta nodicollis* Bates, female from Darjeeling, West Bengal, India. (Body size, 11.5 mm.)

- 4.(3.) Body ventrally almost entirely glabrous except for fringe of setae on free lateral margin of hind coxae (Fig. 4C) . . . *Heptodonta* Hope (Fig. 8)  
 – Body ventrally entirely glabrous (Fig. 4A) . . . . . 5  
 5.(4.) Labrum on most specimens with four setae (Fig. 3A) (a few aberrant specimens with 5 setae) . . . . . *Prothyma* Hope (Fig. 6)  
 – Labrum with six setae . . . . . *Rhytidophaena* Bates

Key to adults of Indian subcontinent

*Cicindela* (*sensu lato*) subgenera

Our treatment of *Cicindela* (*sensu lato*) known from the Indian subcontinent generally follows the formal phylogenetic groupings of Rivalier (1950, 1961), however, from a broader concept of the genus. Thus, we consider all his genera to be subgenera and retain all of his subgenera, but place them under *Cicindela* (*sensu lato*). The following key permits the subgeneric determination of species occurring on the Indian subcontinent:

- 1. Pronotopleural sutures appearing on dorsal surface a short distance mesad lateral margins ..... subgenus *Hypaetha*
  - Pronotopleural sutures appearing on dorsal surfaces at lateral margin ..... 2
- 2.(1.) Elytral maculae on adults of most species forming only a continuous lateral band with or without short medial projections; for adults of some species elytra immaculate, eyes small and bulge only laterally, and posterior angles of pronotum large, acutely projected ..... 3
  - Elytral maculae on adults of most species forming wide separate or fused discoidal spots, or narrow lunules with long, often sinuate, projections onto disc; for adults of some species elytra immaculate, eyes large and bulge dorsally, and posterior angles of pronotum small, subacute to obtuse ..... 4
- 3.(2.) Lateral elytral band on adults of most species irregularly wide with short medial projections at one or two places; for adults of immaculate species, femora short and stocky; flagellum of aedeagus large and curved forming an enlarged cup at base . . subgenus *Salpingophora*
  - Lateral elytral band on adults of most species uniformly thin along the entire lateral edge; for adults of immaculate species, femora long and slender, swollen at base; flagellum of aedeagus small, slender with a thickened, irregularly shaped base ..... subgenus *Callytron*
- 4.(2.) Elytra with basal and subsutural spots or elongate stripes in addition to lateral and discoidal maculae ..... 5
  - Elytra without basal and subsutural spots or elongate stripes; elytral maculae on adults of most species only lateral, discoidal, or both; elytra immaculate on adults of a few species ..... 7
- 5.(4.) Three acute mandibular teeth distad basal molar; decumbent setae on head clustered dorsally at posterior margin of each eye, vertex otherwise glabrous (except for supraorbital setae) . . subgenus *Lophyra*
  - Four acute mandibular teeth distad basal molar; head on adults of most species entirely glabrous (except for supraorbital setae) on vertex; head on adults of some species covered by scattered decumbent setae between eyes and at posterior margin of each eye ..... 6
- 6.(5.) Genae glabrous on adults of most species, sparse erect setae on adults of a few species; head glabrous on adults of most species, scattered appressed setae on vertex on adults of a few species ..... subgenus *Spilodia*
  - Genae densely setose, setae decumbent; head setose, abundant appressed setae on vertex on adults of one species, small patch of dense decumbent setae above antennal insertion on adults of one species ..... subgenus *Chaetodera*

- 7.(4.) Hooked setae numerous and closely spaced along posterior margins of anterior and middle femora; sparser hooked setae on posterior femora ..... 8
- Hooked setae absent from femora on adults of most species; sparse hooked setae basally on anterior and middle femora, absent from posterior femora on adults of a few species ..... 10
- 8.(7.) Labral setae four to six in number, arranged in one row; pronotum glabrous on disc with short, appressed setae laterally ..... 9
- Labral setae 8 to 15 in number, irregularly arranged; pronotum entirely covered by long, appressed setae ..... subgenus *Eriodera*
- 9.(8.) Flagellum of aedeagus forming 1½ to 2 tight concentric coils; femora partly to completely testaceous, translucent ..... subgenus *Monelica*
- Flagellum of aedeagus forming 3½ to 5 tight concentric coils; femora completely metallic, opaque ..... subgenus *Myriochile*
- 10.(7.) Labrum short; more than ten labral setae arranged in 2 or more irregular rows; one wide, elongate or oval macula on apical half of elytra at lateral margin behind middle band, fused to middle band on adults of some species, separated from middle band on adults of others; on adults of all species, lateral macula lies anterior to and separated from apical lunule ..... subgenus *Lophyridia*
- Labrum varied in length and chaetotaxy; long on adults of species with more than ten labral setae; various lengths on adults of most species with ten or fewer labral setae; setae arranged in one row (on adults of some species a few setae medially); elytral maculae on adults of most species at middle of lateral margin consisting only of middle band or its narrow lateral expansion, no separate macula at lateral margin behind middle band; on adults of a few species a narrow elongate spot at lateral margin either fused to middle band or to both it and apical lunule ..... 11
- 11.(10.) Medium to large beetles, body length greater than 12 mm; pronotal form bulky; elytral maculae large, adults of most species with bold spots, for some species broad bands, for some species wide stripes; on adults of immaculate species elytral surface smooth, lacking foveae or glossy and iridescent margins ..... 12
- Small beetles, body length less than or equal to 12 mm; pronotal form slender; elytral maculae small, adults for most species with small oval dots, for some species narrow elongate spots, for some species thin sinuate lunules complete or divided; for a few species immaculate elytral surface roughened, foveae evident, or margins glossy and iridescent ..... 19
- 12.(11.) Frons and vertex of head between eyes with numerous, long, erect setae in addition to two pairs of supraorbital setae . subgenus *Cicindela*
- Frons and vertex of head glabrous except for two pairs of single or multiple supraorbital setae ..... 13
- 13.(12.) Middle elytral macula partially on apical half and extending obliquely from lateral margin onto disc; middle macula on adults of a few species reaches sutural margin as a long, straight or bent band which may fuse with other maculae, but along the entire elytral length; on adults of a few species middle macula forms an oval spot and anterior reflexed margin of pronotum setose; labrum shiny black and/or tes-

- taceous, nonmetallic (a slight metallic tinge laterally present on adults of a few species) ..... 14
- Middle elytral macula varied; on adults of some species entirely lacking; on adults of other species forming an oval or elongate spot, oriented either transversely or longitudinally; middle macula on adults of a few species joined with other basal maculae to form a longitudinal, discoidal stripe continuous or interrupted for the entire elytral length; on adults of a few species middle macula slightly oblique, only at middle or on basal half; anterior reflexed margin of pronotum glabrous; labrum varied, partially or totally metallic blue, green and/or copper on adults of most species, shiny black and testaceous on adults of a few species ..... 16
- 14.(13.) Two or more pairs of multiple supraorbital setae on vertex of head ..... subgenus *Pancallia* ..... 15
- Only two pairs of single supraorbital setae on vertex of head ..... 15
- 15.(14.) Labrum longer than broad with five large, robust teeth coequal in size and evenly spaced; medial carina on labrum ... subgenus *Ancylia*
- Labrum broad with six to ten small feeble teeth, irregularly spaced; labrum flattened, medial carina absent ..... subgenus *Plutacia*
- 16.(13.) Subapical seta on each anterior and middle trochanter; genae with setae or fine hairs; pronotum and head contrasting in surface texture; vertex of head with parallel or wavy rugae; pronotal surface sculpturing on adults of most species smooth to alutaceous, on adults of some species finely wrinkled, but lacking parallel rugae along midline of disc ..... 17
- Anterior and middle trochanters glabrous; genae lacking setae or hairs; pronotum and head similar in surface texture, both finely to moderately wrinkled or rugose, rugae parallel along midline of disc .... 18
- 17.(16.) Body very large (more than 20 mm); labrum extremely long; five large teeth, middle one longest; flagellum of aedeagus spiraled, sustained membrane encasing right side of inner sac in left lateral aspect ..... subgenus *Calochroa* (in part)
- Body large (15 to 20 mm); labrum long; three to five acute teeth subequal in length; flagellum of aedeagus convoluted, sustained membrane forming rounded lobe on right side of inner sac in left lateral aspect ..... subgenus *Cosmodela*
- 18.(16.) Flagellum within aedeagus long and spiraled; elytra maculae varied; minute sublateral spot at middle on adults of one species; four large spots longitudinally arranged on disc on adults of many species (on adults of one species one or more spots fused); a narrow discoidal stripe (continuous or interrupted and ending before apex) on adults of one species; on adults of one immaculate species body length less than 20 mm and terminal segment of abdomen reddish orange ... subgenus *Calochroa* (in part)
- Flagellum within aedeagus short and hooked; elytra maculae broad, longitudinal stripe at middle reaching apex, on adults of one immaculate species body length exceeding 20 mm and terminal segment of abdomen purple to blue-green ..... subgenus *Sophiodela*
- 19.(11.) Flagellum within aedeagus extremely long, forming complicated convolutions which raise several sustained membranes in left and

right lateral aspects; penultimate segment of labial palpi noticeably thickened, the width of each greater than twice that of distal segment; labrum on adults of most species long, covering mandibles; non-standard pattern elytral maculae; two elytral maculae on adults of most species (three on those of one species); spots oval or slightly elongate and situated on apical half at or near lateral margin, medially; bent bands on adults of a few species; on adults of a few immaculate species proepisterna roughened with coarse wavy wrinkles on dorsal half; elytra often with metallic foveae subsuturally and medially on disc contrasting with surface color .....

- ..... subgenus *Jansenia*
- Flagellum within aedeagus forming one to many spirals loosely or tightly coiled only in left lateral aspect without sustained membranes; penultimate segment of labial palpi long and thin, width of each less than or equal to twice that of distal segment; labrum on adults of most species short, exposing mandibles; standard pattern elytral maculae; four or more lunules or oval discal spots on adults of most species; on adults of most species lateral bands narrow or fragmented; on adults of a few species lunules complete; on adults of a few immaculate species proepisterna smooth or shallow parallel wrinkled on dorsal third; elytra lack metallic foveae medially on disc although often present subsuturally ..... 20
  - 20.(19.) Elytral immaculate, smooth, evenly contoured; shiny copper-green and glossy purple-black lateral bands extending mesad; legs pale testaceous; species of smallest adult body size (less than 6.5 mm) ..... subgenus *Glomera*, new subgenus
  - Elytra maculae present on adults of most species although one or more spots may be reduced to faint dots; on adults of one species lateral margins solely glossy black and extend mesad; on adults of one species elytra immaculate but surface rough and unevenly contoured; legs opaque metallic; species of larger adult body size (more than 6.5 mm) ..... 21
  - 21.(20.) Elytral maculae on adults of most species forming separate oval or elongate spots only laterad along margin or submarginally; on adults of a few species middle band short, broad, not extending past middle of disc ..... 22
  - Elytral maculae on adults of most species forming spots, lunules or bands both laterad and mesad; on adults of a few species oval spots extend past middle of disc toward suture; adults of one species immaculate ..... 24
  - 22.(21.) Two oval elytral spots laterally on apical half; elytral disc polished, surface either smooth or uneven from raised areas; elytral apex distinctly microserrulate; eyes large, prominent; hind wings normal size ..... 23
  - Two or more small, narrow elytral spots laterally on adults of some species; short broadly bending middle band on adults of other species; elytral disc dull with large impunctate areas or slightly shiny from punctures; elytral apex either smooth along edge or finely microserrulate; eyes small, not prominent; hind wings on adults of most species reduced in size ..... subgenus *Cylindera*

- 23.(22.) Labrum with medial setae originating at anterior margin from between teeth ..... subgenus *Setinteridenta*  
 – Labrum with medial setae originating submarginally ..... subgenus *Oligoma*
- 24.(21.) Elytral lunules incomplete, divided; on adults of most species maculae fragmented into small spots situated both medially and laterally; on adults of a few species all spots medially situated; on adults of a few species spots faint; middle band, if present, narrowly complete, oblique and not sinuate, ending medially on disc; apical lunule on adults of most species reduced to a lateral spot; on adults of a few species short extension of apical lunule not reaching suture; male antennae lacking a penicillum of clubbed setae ..... subgenus *Ifasina*  
 – Elytral lunules complete, undivided; maculae on adults of most species broadly fused at lateral margin; middle band comprised of a short transverse portion and a long, sinuate portion extending nearly to suture; apical lunule present on adults of most species complete and touching suture; male antennal penicillum of clubbed setae on adults of a few species ..... subgenus *Eugrapha*

### Subgenus *Cicindela* (*sensu stricto*) Linnaeus

*Cicindela* Linnaeus, 1758:407

Type species.—*Cicindela campestris* Linnaeus, 1758.

*Cicindela* (*sensu stricto*) Linnaeus: Rivalier, 1950:223.

*Nomenclatural note*.—Walther Horn (1926) provided a lengthy synonymy for this species.

*Diagnosis*.—*Cicindela* (*sensu stricto*) species adults can be distinguished from those of related subgenera by: 1) the flagellum of male genitalic inner sac forming a short basal hook on the dorsal aspect; 2) the presence of a standard pattern of elytral maculation comprised of only a humeral lunule, middle band and apical lunule, all separate and touching the lateral margin of elytra.

*Included species*.—Only one species representative of the Palearctic biogeographic region subgenus *Cicindela* (*sensu stricto*) enters the extreme northwestern parts of the Indian subcontinent: *C. (C.) granulata stoliczkana* Bates, 1878.

### *Cicindela* (*Cicindela*) *granulata stoliczkana* Bates

*Cicindela granulata* Gebler, 1843:36.

*Type status*. Syntype(s)? [unexamined; concept based on specimen! from U.S.S.R.: Kazakh S.S.R., Sari-dias: Ken-su, Semirjetschensk at CMNH]. *Type depository*. ?ZISL. *Type locality*. “Turkestan (Kazakh S.S.R., U.S.S.R.).”

*Cicindela stoliczkana* Bates, 1878a:713.

*Type status*. Syntype(s)? [unexamined; concept based on female! from Kashgar, Sinkiang Uighur Autonomous Region, China, at SMTD]. *Type depository*. ?ZSI (Heynes-Wood and Dover, 1928). *Type locality*. “North of the Kuen-lun” (Kun Lun Mountains, China).

*Cicindela wilkinsi* Dokhtouroff, 1885:279, pl. 11, fig. 3.

*Type status*. Holotype, female [by monotypy; unexamined; synonymy follows Horn (1926)]. *Type depository*. ?DEI. *Type locality*. “Karateghinoise, 8–9,000 ft, Mouk-sou Riviere” (Kirghiz S.S.R., U.S.S.R.).

*Cicindela burmeisteri stoliczkana* Bates: Beuthin, 1894:266.

*Cicindela granulata* var. *stoliczkana* Bates: Horn, 1926:223.

*Cicindela granulata stoliczkana* Bates: Heynes-Wood and Dover, 1928:90.

*Cicindela (Cicindela) granulata* Gebler: Rivalier, 1950:224.

*Description.*—*General habitus.* Body large (15–18 mm); head and pronotum shiny black dorsally; elytra dull black to purple-black; yellow maculae forming a standard but varied pattern; body dark blue-black ventrally. *Head.* Antennal scape with several subapical setae; labrum long, testaceous, one medial tooth and 8 to 12 submarginal setae; clypeus and genae glabrous; frons and vertex of head with abundant, long, erect setae in addition to numerous pairs of supraorbital setae; vertex concave between eyes, surface finely rugose. *Prothorax.* Pronotum quadrate; anterior and posterior transverse sulci shallow; pronotum finely wrinkled, sparse long erect setae sublaterally; proepisternal setae dense and erect; prosternum glabrous. *Pterothorax.* Female mesepisterna broadly and shallowly grooved, groove slanting posteriorly; pleura and sterna moderately setose. *Elytra.* Surface slightly granulate-punctate, punctures noncontrasting and deepest basally, shallowest apically; maculae yellow and varied; humeral lunule complete; middle band broadly transverse to oblong, on some specimens fused to humeral lunule, on others separated from it; apical spot large, oblong, often divided and extending toward suture; apex not microserrulate; sutural spine small. *Abdomen.* Sparse short semierect setae on first few sterna. *Legs.* Front and middle trochanters black, one to three subapical setae on each segment; femora purple to black; tibiae and tarsomeres black. *Male genitalia.* Aedeagus long and slender, uniformly tapering to an acutely rounded apex; concavity with sclerotized ridges on right below apex; slightly raised flange in left and right lateral aspects.

*Geographic variation.*—This species has a varied pattern of elytral maculae such that several subspecies have been described from the Palearctic biogeographic region. Nominate subspecies lacks a humeral lunule, whereas *C. granulata stoliczkana* has a broad, complete humeral lunule. Specimens from western China in the Tarim Basin tend to have the middle band widened, transverse and often fused to humeral lunule; whereas specimens in the upper portions of the Aral Sea drainages in Soviet central Asia have the middle band oval or elliptical with a short medial projection.

*Distribution.*—(Fig. 36). Extreme northwest mountainous part of the Indian subcontinent in Pakistan (Punjab, Northwest Frontier) northward into western China and Soviet central Asian republics.

*Localities.*—CHINA: Sinkiang Uighur Autonomous Region: K'ashih (Kashgar), VIII.1904 (SMTD); Tien Shan (Mts.), Wensu (Aksutal) (SMTD). U.S.S.R.: Kazakh S.S.R.: Daharkent, Kuldsha (SMTD); Sari-dias: Ken-su, Semirjetchensk (SMTD, CMNH). Listed by Heynes-Wood and Dover (1928) from India, Jammu and Kashmir, Jhelum Valley.

*Ecology.*—Adults of this species occur in subalpine mountains on locally bare or sparsely vegetated areas (Wilkins, 1889).

### Subgenus *Cicindela (Sophiodela)* Nakane

*Cicindela (Sophiodela)* Nakane, 1955:26.

Type species.—*Cicindela japonica* Thunberg, 1781.

*Cicindela (Sericina)* Rivalier, 1961:123.

Type species.—*Cicindela chinensis* Degeer, 1774.

*Diagnosis.*—*Cicindela (Sophiodela)* species adults are distinguished from those of related subgenera by: 1) large semisclerotized shield dorsally within the aedeagal inner sac; 2) large to very large body; 3) labrum five-toothed; 4) elytral markings short, transverse, forming a continuous medial stripe of varied length on some species.

*Included species.*—Most members of subgenus *Cicindela (Sophiodela)* are found in the extreme eastern portions of the Palearctic biogeographic region with only one species recorded from northeastern India: *C. (S.) cyanea* Fabricius, 1787.



*Cicindela (Sophiodela) cyanea* Fabricius*Cicindela cyanea* Fabricius, 1787:185.

*Type status.* Lectotype, male [here designated]. *Type labels.* [Small green unmarked square]; "Type" [red typeset]; "Ind: Orient: Vahl., Mus: S: & T:L.; Cicindela cyanea F." [handscript]; "Zool. Museum, DK Copenhagen" [typeset]; "LECTOTYPE, Cicindela, cyanea Fabricius, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 19.5 mm; lacking all appendages except part of right antenna, entire left front leg, right front and hind femora.] *Type depository.* Lectotype at ZMUC. *Type locality.* "Indes Oriental."

*Cicindela dejeanii* Hope, 1831:21, new synonymy.

*Type status.* Lectotype, male [here designated]. *Type labels.* "Syn-, type" [typeset circular label with blue border]; "Type" [typeset circular label with red border]; "Nepal/3920,a" [handscript on both sides of circular label]; "Cicindela Dejeanii, (Type)" [handscript, "Type" underlined]; "LECTOTYPE, Cicindela, dejeanii Hope, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 21 mm; previously pinned through left elytron; left middle tibia, entire left hind leg, and both antennae missing.] *Type depository.* Lectotype at BMNH. *Type locality.* "Nepal."

*Cicindela obliquevittata* Fleutiaux, 1898:147.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* ?MNHN. *Type locality.* "Chota Nagpore" (Chota Nagpur, Bihar, India).

*Cicindela (Sericina) cyanea* Fabricius: Rivalier, 1961:123.

*Description.*—*General habitus.* Body large to very large (19.5–23 mm); head and pronotum dull black dorsally, shiny blue or green laterally; elytra dull blue or blackish green either entirely immaculate on some specimens or wide lengthwise medial elytral stripe on others; body shiny purple and green ventrally. *Head.* Labrum black medially, metallic purple and green laterally with five acute teeth, subequal in length and six submarginal setae; frons with fine parallel longitudinal rugae; vertex finely rugose, rugae forming numerous parallel ridges near eye, rugae irregular to slightly transverse medially. *Prothorax.* Pronotum moderately rugose; anterior and posterior transverse sulci deep; pronotal surface glabrous, one or two lateral setae present at anterior margin on a few specimens; proepisterna smooth at middle, finely and parallel wrinkled dorsally, entire surface nearly glabrous on female (only a few sparse erect setae along anterior margin), ventral two-thirds of surface with sparse, erect setae on male; prosternum glabrous. *Pterothorax.* Female mesepisterna broadly concave, lacking a groove. *Elytra.* Surface dull, finely and densely granulate-punctate; punctures shallow and purple on disc; larger and deeper nongranulate punctures and slightly shiny green or purple laterally; maculae on some specimens almost totally lacking, on others forming a wide, orange stripe down the middle of elytron; elytral apex finely microsculptate; sutural spine short, obtuse. *Abdomen.* Scant appressed setae laterally only on first few sterna. *Legs.* Trochanters black, glabrous; femora purple and green; tibiae and tarsomeres black. *Male genitalia.* Aedeagus large, uniformly wide from below middle nearly to apex; tapering abruptly and bending slightly to the right before ending in a blunt tip; short slightly raised flange subapically on the middle in left and right lateral aspects.

*Geographic variation.*—Specimens assignable to nominal *Cicindela cyanea* lack the wide, longitudinal orange stripe which characterizes *C. cyanea dejeanii*, but because both named subspecies reportedly occur together (Fowler, 1912), we do not consider *C. cyanea dejeanii* a subspecies.

*Distribution.*—(Fig. 36). Eastern Nepal, northern Bangladesh and northeastern India (Bihar, West Bengal, Orissa).

*Localities.*—INDIA: Bihar: Chota Nagpore, VI-VII.1887 (SMTD); Chota Nagpur (MCZC). BANGLADESH: Dinajpur District: Dhanjuri, V.1963 (CMNH).

*Ecology.*—The habitat is unrecorded but presumably adults have a restricted habitat preference because extensive recent searching by the second author in India failed to locate this species.

Subgenus *Cicindela* (*Pancallia*) Rivalier

*Cicindela* (*Pancallia*) Rivalier, 1961:124.

Type species.—*Cicindela princeps* Vigors, 1825.

**Diagnosis.**—Adult males of *Cicindela* (*Pancallia*) species, while similar to the *Cicindela* (*sensu stricto*) by having the short, hooked flagellum within the inner aedeagal sac, can be distinguished from males of related subgenera by: 1) large to very large black body; 2) sparse, dark setae on much of the dorsal surface and moderate setae ventrally; 3) bulky head, eyes not prominent, two paired groups of multiple (two to four) supraorbital setae on several of the species; 4) pronotum bulky, deeply incised transverse sulci, surface coarsely pebbled; 5) elytral maculae yellow-orange or white forming two or three broad, transverse markings touching the lateral and, on adults of some species, the sutural margins medially and at humeral and apical angles (on adults of one species the maculae have fused into broad patterns).

**Included species.**—The following species, all confined to southern India, are included in subgenus *Cicindela* (*Pancallia*): *C. (P.) princeps* Vigors, 1825; *C. (P.) aurofasciata* Dejean, 1831; *C. (P.) angulicollis* Horn, 1900; *C. (P.) shivah* Parry, 1848.

Key to adults of *Cicindela* (*Pancallia*) species

1. Genae setose ..... *shivah* Parry
  - Genae glabrous ..... 2
- 2.(1.) Humeral elytral lunule long, extending onto disc and often to suture; elytral maculae often joined or fused ..... *aurofasciata* Dejean
  - Humeral elytral lunule short, not extending onto disc; elytral maculae not joined or fused ..... 3
- 3.(2.) Elytral surface smooth and impunctate; middle band only on posterior half of each elytron, not touching sutural ridge ..... *angulicollis* Horn
  - Elytral surface shallowly punctured; middle band on both halves of each elytron, touching sutural ridge ..... *princeps* Vigors

*Cicindela* (*Pancallia*) *princeps* Vigors

*Cicindela princeps* Vigors, 1825:413, pl. 15, fig. 1.

**Type status.** Lectotype, female [here designated]. **Type labels.** “Type” [typeset circular label with red border]; “Madras, Major Sale” [typeset]; “59-57, Vigors Coll.” [typeset]; “princeps. V.” [handscript]; “LECTOTYPE, *Cicindela*, princeps Vigors, by R.E. Acciavatti, '83” [typed and handprinted red label]. [Lectotype is 20 mm.] **Type depository.** Lectotype at BMNH. **Type locality.** “Madras” (Tamil Nadu city, India).

*Cicindela princeps ducalis* Horn, 1897d:254.

**Type status.** Lectotype, female [here designated]. **Type labels.** “Co-, type” [typeset on circular label with yellow border]; “Chota-Nagpore, Palkot, R.P. Cardon, VI-VII 1897” [typeset on label with black line at border]; “V. ducalis, type W. Horn” [handscript, ‘V’ underlined]; “F. Bates coll., 1911-248” [typeset]; “LECTOTYPE, *Cicindela*, princeps ducalis W. Horn, by R.E. Acciavatti, '83” [typed and handprinted red label]. [Lectotype is 18.5 mm.] **Paralectotype**, female [here designated] labelled “PARALECTOTYPE” [typed and handprinted red label]. **Type depository.** Lectotype at BMNH; paralectotype at MCZC. **Type locality.** “Chota Nagpore” (Bihar, India).

*Cicindela princeps* Vigors: Fowler, 1912:409, fig. 17.

*Cicindela princeps pochoni* Mandl, 1958:28.

**Type status.** Holotype, female [by original description; unexamined]. [We are uncertain about the placement of this subspecies; its synonymy under *C. princeps* is provisional; its original description

indicates elytral maculation like *C. aurofasciata goryi* Chaudoir with which it may prove to be synonymous when the *C. princeps pochoni* holotype is examined.] *Type depository*. ?Holotype at ZSBS. *Type locality*. "Kotagri, Nilgeridish, South India."

*Cicindela (Pancallia) princeps* Vigors: Rivalier, 1961:124.

*Diagnosis*.—Distinguished by the short elytral humeral lunule; elytral surface shallowly punctured on disc.

*Description*.—*General habitus*. Body large (18.5–20 mm); body form robust; head and pronotum shiny black and strongly rugose; elytra dull black with three broad, oblique yellow lunules; body black ventrally. *Head*. Vertex strongly and densely rugose, dorsally entirely glabrous except for two pairs of multiple supraorbital setae. *Prothorax*. Pronotal surface strongly and densely rugose; sparse, dark appressed and semierect setae over entire pronotal surface; proepisterna glabrous except for a few setae near coxal margin. *Pterothorax*. Female mesepisterna broadly concave. *Elytra*. Surface dull; punctures shallow; maculae yellow, forming humeral lunule, oblique band on center of elytra from lateral to sutural margins, and short apical lunule touching sutural ridge but ending before outer apical angle; surface sculpturing and pattern of maculae varied (see geographic variation). *Abdomen*. Almost totally glabrous except for a few scant setae on third and fourth sterna (most frequent on males) and primary setae on same sterna at posterior margin. *Legs*. Trochanters dark brown to black, glabrous; femora, tibiae and tarsomeres shiny black. *Male genitalia*. Aedeagus slender, nearly uniform width for most of its length; tapering abruptly to a blunt tip; subapical flanges asymmetrical, in left lateral aspect moderately raised at middle before abruptly ending basally, in right lateral aspect slightly raised.

*Geographic variation*.—We recognize two subspecies, nominal *Cicindela princeps princeps* and *C. princeps ducalis*, that differ from one another by elytral sculpture and pattern of maculae. The nominal subspecies has a dull elytral surface between maculae with shallow, noncontrasting punctures anterior to middle band and is nearly impunctate posterior to middle band, whereas, *C. princeps ducalis* has shallow, bluish green to slight copper punctures throughout which contrast with remainder of surface; *C. princeps ducalis* also differs from the nominal subspecies by a narrower and more oblique humeral lunule and middle band. These two subspecies may each deserve separate species ranking if further study of populations along the Eastern Ghats fails to discover hybrids. The rank of *Cicindela princeps pochoni* Mandl remains uncertain until its type has been examined.

*Distribution*.—(Fig. 37). *Cicindela princeps princeps* occurs in southern India (Tamil Nadu); *C. princeps ducalis* from central India (Bihar, Orissa, Madhya Pradesh, Andhra Pradesh).

*Localities*.—*Cicindela princeps princeps*. INDIA: Tamil Nadu: 15 km N Salem, 660 m, 26.VI.1984, scrub forest floor (DLPC, CMNH). *Cicindela princeps ducalis*. INDIA: Bihar: 85 km W Ranchi, 23.VI.1986, scrub forest (DLPC); 17 km W Hazaribagh, 21.VI.1986, scrub forest (DLPC); Chota Nagpur, Palkot, VI.1897 (CMNH); Orissa: Simlipal National Park, 25.VI.1986, forest path (DLPC); Madhya Pradesh: Kanha National Park, 14–16.VI.1982, forest path (DLPC, CMNH); Andhra Pradesh: 11 km W Narsipatnam, 28.VI.1986, scrub forest (DLPC); 15 km S Salur, 30.VI.1986, scrub forest (DLPC).

*Ecology*.—Adults emerge during the premonsoon rains. In South India, they occur on mountainsides, usually in openings of tall grass in scrub forests. They are also common along paths and dirt roads through open forests and make moderate flights when disturbed, although Fowler (1912) reported them to be comparatively sluggish and easily captured by hand.

### *Cicindela (Pancallia) aurofasciata* Dejean

*Cicindela aurofasciata* Dejean, 1831:224.

*Type status*. Syntype(s)? [unexamined; concept based on comparing description with specimens! labelled "India, Karnataka, Chikmagalur District, Bababudan Hills, 6000 ft (1845 m), V.1982" at CMNH]. *Type depository*. ?MNHN. *Type locality*. "Indes Oriental."

*Calochroa crucigera* Hope, 1838:162, pl. 1, fig. 2.

*Type status.* Lectotype, male [here designated]. *Type labels.* "34" [typeset]; "Bowring, 6347\*" [typeset]; "Aurofasc., Typus" [handscript]; "C. cruciger, India" [handscript]; "LECTOTYPE, Calochroa, crucigera Hope, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 15 mm; right middle tarsomeres missing; agrees with Hope's description and figure for *C. crucigera*.] *Type depository.* Lectotype at BMNH. *Type locality.* "Nilgherry Mountains, Madras" (Nilgiri Mountains, Tamil Nadu, India).

*Cicindela lepida* Gory, 1833: pl. 96 (preoccupied, Dejean, 1831:255).

*Type status.* Syntype(s)? [unexamined; concept based on specimens! labelled "India, Karnataka, 15 km N Bangalore, 12.VI.1983, forest path" at DLPC]. *Type depository.* ?MNHNP. *Type locality.* "Indes Orientales, Deccan" (India).

*Cicindela goryi* Chaudoir, 1852:1 (replacement name).

*Cicindela princeps aurofasciata* Dejean: Schaum, 1863:64.

*Cicindela aurofasciata* Dejean: Fowler, 1912:407, fig. 174.

*Cicindela aurofasciata seminigra* Fowler, 1912:408.

*Type status.* Holotype, female! [by original description]. *Type depository.* Holotype at BMNH. *Type locality.* "India."

*Cicindela aurofasciata goryi* Chaudoir: Horn, 1915:304.

*Cicindela (Pancallia) aurofasciata* Dejean: Rivalier, 1961:124.

*Cicindela aurofasciata latefasciata* Mandl, 1957:11, new synonymy.

*Type status.* Holotype [by original description; unexamined; concept based on its original description]. *Type depository.* ?Holotype at ZSBS. *Type locality.* "Nilgiri Hills, Moyer Camp, 3000 ft, South India."

*Nomenclatural note.*—When Hope (1838) described *C. crucigera*, he mentioned *Cicindela erichsoni* and *C. lichtensteini* but failed to describe or figure them; therefore, these two latter names are unavailable. We believe the two apparently syntypic females! of *C. crucigera* at HMO are the *C. erichsoni* and *C. lichtensteini* of Hope. However, these specimens should be referred to *C. aurofasciata goryi* Chaudoir, the first available name, because their humeral lunule and middle band are broadly fused rather than separated.

*Diagnosis.*—Distinguished by the long humeral lunule extending onto the disc and nearly reaching the suture.

*Description.*—*General habitus.* Body large to very large (15–23 mm); body form robust; head and pronotum shiny black or dark bronze, slight greenish reflections; elytra dull black; yellow maculae forming two broad, oblique bands; body black to purple ventrally. *Head.* Vertex strongly rugose; two pairs of multiple supraorbital setae; labrum mostly black, on most specimens testaceous medially, on some specimens almost entire basal half testaceous. *Prothorax.* Pronotum strongly rugose; sparse dark setae over entire surface. *Pterothorax.* Female mesepisterna broadly concave. *Elytra.* Dark surface of most specimens flecked with iridescent bluish green or copper (flecks inconspicuous on some specimens); elytral maculae broad and yellow, forming a varied pattern; humeral lunule and middle band oblique to each other and nearly meeting at the suture on some specimens, fuse together on others; apical lunule separate on most specimens but joined to middle band on a few others. *Abdomen.* Sparse setae laterally on proximal second to fifth sterna. *Legs.* Trochanters shiny black, glabrous; femora black, purple or purplish green; tibiae and tarsomeres black. *Male genitalia.* Aedeagus moderately slender, uniformly wide on middle half, slightly wider on distal quarter; gradually tapering to a blunt tip; short prominent flange evident subapically only in left lateral aspect.

*Geographic variation.*—We recognize two subspecies: *Cicindela aurofasciata aurofasciata* has an oblique elytral humeral lunule and a middle band which nearly meet at the suture; *C. aurofasciata goryi* has these maculae broadly fused. In addition, two aberrational patterns of elytral maculae occur sporadically; aberration *C. aurofasciata latefasciata* possesses an apical lunule fused to a broad

middle band at the lateral margin and aberration *C. aurofasciata seminigra* lacks an apical lunule.

*Distribution.*—(Fig. 37). *Cicindela aurofasciata aurofasciata* from India (Madhya Pradesh, Maharashtra, Karnataka, Tamil Nadu); *C. aurofasciata goryi* from India (Karnataka and Tamil Nadu).

*Localities.*—*Cicindela aurofasciata aurofasciata*. INDIA: Karnataka: Chikmagalur District, Bababudan Hills, 1845 m, V.1982 (CMNH); Deccan (Plateau) (SMTD); Tamil Nadu: 16 km W Ootacamund, 15.VI.1983, old field (DLPC); Coromandel (Coast) (SMTD); Nilgiri Hills, Kodawad, 1385 m, IV.1954 (CMNH). *C. aurofasciata goryi*. INDIA: Karnataka: Shimoga, 575 m, 28.VI.1937 (JSC); 50 km W Dharwar, 520 m, 14.VI.1987, forest path (DLPC); 10 km E Hoskote, 22.VII.1986, scrub forest (DLPC); 15 km N Bangalore, 12.VI.1983, forest path (DLPC, CMNH); Tamil Nadu: Nilgiri Hills, Singira, 985 m, 28.V.1948 (RMC); Kerala: Calicut District, V.1970 (CMNH).

*Ecology.*—A different habitat preference and flight behavior for adults are evident for the two recognized subspecies. The lower elevation subspecies, *C. aurofasciata goryi*, occurs between 600 to 1500 m elevation, on the floor of secondary and primary forests and brushy areas. This subspecies readily flies for 2 to 5 m. The high elevation subspecies, *C. aurofasciata aurofasciata*, occurs above 2000 m, in open grassy areas and flies no more than a meter when disturbed. Fowler (1912) also gave a fairly detailed account of the differences in flight behavior between these two subspecies. The larvae of *C. aurofasciata goryi* construct unique turrets that bend to the substrate surface (Shivashankar et al., 1988).

### *Cicindela (Pancallia) angulicollis* Horn

*Cicindela (Calochroa) angulicollis* Horn, 1900:209.

*Type status.* Holotype, female! [by monotypy]. *Type depository.* Holotype at DEI. *Type locality.* "Dacca" (?Bangladesh) [the holotype probably originated from somewhere on the Deccan Plateau in India, rather than in the Ganga River Delta at Dacca, Bangladesh].

*Cicindela (Pancallia) angulicollis* Horn: Rivalier, 1961:124.

*Diagnosis.*—Distinguished by the short humeral lunule not reaching onto the disc; elytral disc impunctate.

*Description.*—*General habitus.* Body large to very large (19–22 mm); body form robust; head and pronotum entirely black; elytra dull black, three large yellow or white maculae; body black ventrally. *Head.* Labrum black, large, yellowish white triangular spot medially; frons and vertex densely rugose; vertex with two pairs of multiple supraorbital setae. *Prothorax.* Pronotum densely rugose, sparse setae over entire surface; lateral sides of pronotum in dorsal view parallel to slightly concave anteriorly. *Pterothorax.* Female mesepisterna broadly concave, lacking a groove. *Elytra.* Surface smooth and impunctate; large yellow (pale or dark) or white maculae; humeral and apical lunules short; middle band longer, on posterior half of elytra not touching suture. *Abdomen.* Sterna glabrous to sparsely setose laterally. *Legs.* Trochanters shiny black, glabrous; femora purple; tibiae and tarsomeres purplish black to black. *Male genitalia.* Aedeagus slender, widest on apical third, uniformly tapering from there toward base; abruptly tapering to an evenly rounded tip; short prominent flange situated medially in left lateral aspect midway along length of apical orifice; flange in right lateral aspect longer, less prominent and asymmetrically placed in relation to left lateral flange.

*Distribution.*—(Fig. 37). Southern India (Tamil Nadu, Kerala). The type locality of Dacca (?Bangladesh) appears to be incorrect.

*Localities.*—INDIA: Tamil Nadu: Tiruchchirappalli District, Pudukkottai, X.1973 (RLHC); 20 km E Pudukkottai, 250 m, 23–24.IX.1986, scrub forest (DLPC); 25 km S Pollachi, 19.VI.1983, forest path (DLPC, CMNH); Kerala: Palghat District, 20 km E Palghat, 18.VI.1983, forest path (DLPC, CMNH).

*Ecology.*—Adults are found on the floor of second growth forests such as teak plantations and in openings of primary forests at intermediate elevations; occasionally in tall grass within 500 m of forests. This species is a moderately strong flier and takes off quickly when disturbed.

*Cicindela (Pancallia) shivah* Parry

*Cicindela (Calochroa) shivah* Parry, 1848:80, pl. II. fig. 2.

*Type status.* Lectotype, female [here designated]. *Type labels.* "Cicind., shivah, Parry/Name passed, by Dr. W. Horn, in Mus. Brit." [first three lines manuscript on top of label, remainder typeset on reverse side]; "Shivah Parry, Tr. Ent. Soc." [handscript on folded blue label]; "F. Bates Coll., 1911-248" [typeset]; "Cicindela shivah Parry det. R.E. Acciavatti, '81" [handprinted]; "LECTOTYPE, Cicindela, shivah Parry, by R.E. Acciavatti, '84" [typed and handprinted red label]. [Lectotype is 18 mm; both antennae broken; right hind tarsomeres missing; left elytron has a large hole opposite pin.] *Type depository.* Lectotype at BMNH. *Type locality.* None stated, but Ceylon (Sri Lanka) implied, however, this is almost certainly not where the lectotype originated.

*Cicindela (Pancallia) shivah* Parry: Rivalier, 1961:124.

*Nomenclatural note.*—The following published names have been associated with this species: *boisduvalii* Dejean, 1837:2; *shivah* Parry, 1845:84, however, because they were neither described nor figured, they are unavailable.

*Diagnosis.*—Distinguished by the three separate elytral maculae; abundant setae cover head and pronotum.

*Description.*—*General habitus.* Body large (17–18 mm); body form elongate, moderately robust; dorsum black; elytra with three bold yellow spots; ventral surfaces of body black. *Head.* Labrum black, five teeth on anterior margin, six submarginal setae, medial carina; clypeus sparsely setose; genae setose, setae dark, sparse and erect; frons and vertex densely and irregularly rugose, covered by dark erect setae; frons convex, bulging; antennal scape with several setae besides subapical primary seta. *Prothorax.* Pronotum densely and irregularly rugose, covered by dark erect setae; pronotal shape abruptly constricted at anterior and posterior transverse sulci; widest just behind anterior sulcus where lateral sides of pronotum create a broad, obtuse anterior angle, remainder of lateral margin sloping inward posteriorly; anterior reflexed margin of pronotum wide, broadest at middle; prosternum setose, setae sparse and erect; proepisterna shiny black, dorsally surface shallow and wavy, sparse erect setae becoming most numerous at coxal margin. *Pterothorax.* Female mesepisterna broadly concave, lacking a groove. *Elytra.* Form elongate, parallel sided; surface dull, black, slightly shiny purple at lateral margins; punctures on disc broad, noncontrasting, deepest basally; surface covered by numerous erect setae especially basally; elytral maculae yellow forming three large elongate spots; humeral lunule short; apical lunule lacking a basal expansion; transverse middle band projecting slightly anteriorly and extending from lateral margin where it is widest nearly to suture. *Abdomen.* Sterna moderately and sparsely setose. *Legs.* Trochanters pitchy black, glabrous; femora, tibiae and tarsomeres metallic purple-black. *Male genitalia.* Not examined.

*Distribution.*—(Fig. 37). India (Karnataka, North Kanara District). This species was listed by Fowler (1912) from Nepal, and by Heynes-Wood and Dover (1928) from various places in India and Bangladesh; all of which appear to be incorrect.

*Localities.*—INDIA: Karnataka: North Kanara District, Belgaum, 17.VII.1910 (BMNH).

*Ecology.*—The habitat of this rare species is unrecorded but it probably inhabits forests.

*Remarks.*—Fowler (1912) referred to a specimen of *Cicindela shivah* he had seen at BMNH as *C. flavomaculata* Hope, but this specimen! is *C. shivah* Parry. No males were available to us for study so we were unable to confirm the subgeneric placement of this species.

Subgenus *Cicindela* (*Ancylia*) Rivalier

*Cicindela* (*Ancylia*) Rivalier, 1961:124.

Type species.—*Cicindela guttata* Wiedemann, 1823.

**Diagnosis.**—Adults of *Cicindela* (*Ancylia*) species are similar to those of *Cicindela* (*sensu stricto*) in several respects: 1) males possessing a thick and bulky, short, hooked flagellum within the internal sac of the aedeagus; 2) body medium to large, mostly glabrous; 3) head bulky, eyes less prominent; 4) pronotum deeply incised, surface moderately pebbled. However, *Cicindela* (*Ancylia*) species adults can be distinguished from those of related subgenera by: 1) two pairs of single (one pair double on a few specimens) supraorbital setae; 2) elytral maculae yellow-orange or whitish, widely separated on some specimens and fused on others, one or more maculae form broad, slanting markings medially on elytra which touch only the lateral margin at the humeral and outer apical angles.

**Included species.**—The species of *Cicindela* (*Ancylia*) occur only in India and Sri Lanka: *C. (A.) guttata* Wiedemann, 1823; *C. (A.) andrewesi* (Horn, 1894); *C. (A.) calligramma* Schaum, 1861; *C. (A.) ceylonensis* Horn, 1892; *C. (A.) diversa* Horn, 1904, new rank.

Key to adults of *Cicindela* (*Ancylia*) species

1. Genae glabrous; pronotum longer than wide ..... *andrewesi* (Horn)
  - Genae on most specimens setose; specimens with glabrous genae have pronotum wider than long ..... 2
- 2.(1.) Proepisterna nearly covered by sparse appressed and semierect setae originating from large punctures; middle band transverse, on most specimens curved apically at discal end ..... *calligramma* Schaum
  - Proepisterna on some specimens mostly glabrous, on other specimens appressed setae only on ventral half originating from minute punctures; middle band oblique or represented only by an oval spot ..... 3
- 3.(2.) Anterior elytral macula situated laterally, completely encompassing humeral angle but not broadly projecting toward scutellum; middle macula a large circular spot, on some specimens fused with other maculae, on other specimens separated; metepisterna sparsely setose anteriorly and posteriorly ..... *guttata* Wiedemann
  - Anterior elytral macula situated medially, encompassing humeral angle only anteriorly but projecting toward and nearly reaching scutellum; middle macula a stripe, obliquely transverse, not fused with humeral or apical lunule; metepisterna glabrous except for a few setae posteriorly ..... 4
- 4.(3.) Anterior elytral macula elongate, nearly straight, reaching to middle; middle stripe short, obliquely transverse, medially situated and straight ..... *ceylonensis* Horn
  - Anterior elytral macula short, oblique, not reaching to middle; middle stripe long, nearly reaching lateral and sutural margins and often arcuate ..... *diversa* Horn

*Cicindela* (*Ancylia*) *guttata* Wiedemann

*Cicindela guttata* Wiedemann, 1823:63.

**Type status.** Lectotype, male [here designated]. **Type labels.** “Mus. Westerm.” [typeset]; “3” [printed small square]; “TYPE” [red typeset]; “Bengal, Juli 1809, Guttata, Wied.” [handscript]; “Zool. Museum,



DK Copenhagen" [typeset]; "LECTOTYPE, *Cicindela, guttata* Wiedemann, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 14 mm.] [An apparent syntypic female! at ZMUC is not conspecific with *C. guttata* because its head possesses different characters, from which we conclude that this remaining syntype is a composite insect of questionable scientific value.] Paralectotype, female [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository.* Lectotype at ZMUC; paralectotype at MNHB. *Type locality.* "Bengal."

*Cicindela guttata* Wiedemann: Fowler, 1912:412, fig. 176.

*Cicindela (Ancyliia) guttata* Wiedemann: Rivalier, 1961:125.

**Diagnosis.**—Distinguished by the humeral elytral angle completely encompassed by a macula restricted to the humeral angle; proepisterna glabrous dorsally, minutely punctured ventrally.

**Description.**—*General habitus.* Body medium to large (13.5–16 mm); body form moderately slender; dorsum dark green, head and pronotum shiny; elytra with large yellow spots; body shiny purple-green ventrally. *Head.* Labrum long, five acute teeth, four submarginal setae, anterior one quarter dark, remainder ivory; frons, vertex glabrous on most specimens; genae sparsely setose ventrally (glabrous on a few specimens); vertex with parallel rugae adjacent to eyes, rugae irregular at middle and behind eyes. *Prothorax.* Pronotum wider than long, its width behind anterior transverse sulcus subequal to that in front of posterior transverse sulcus; pronotal surface coarsely rugose, midline evident; anterior and posterior transverse sulci moderately impressed; pronotum with moderately abundant appressed setae along lateral and anterior reflexed margins; posterior reflexed margin glabrous; proepisterna with moderate appressed setae on ventral half originating from minute punctures, completely glabrous and shiny on dorsal half with shallow wavy wrinkles evident; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus widely grooved dorsoventrally. *Elytra.* Dull, dark green or black-green; yellow markings forming humeral and apical lunules, and a large spot at the middle; the lunules are varied, some specimens showing divided maculae, others reduced maculae, others maculae joined to the middle spot; on some specimens a small basal spot occurs midway between humeral lunule and scutellum. *Abdomen.* Anterior three sterna covered by dense decumbent setae laterally, almost totally glabrous ventrally; fourth through sixth sterna only sparsely setose laterally. *Legs.* Trochanters dark brown to pitchy black, nonmetallic, glabrous; femora metallic bronze-green, tibiae and tarsomeres metallic copper-green. *Male genitalia.* Aedeagus short, stocky, widest at middle and uniformly wide distally to base of apical orifice; short distal section displaced to the right and tapering abruptly to a blunt rounded tip; a short flange in both lateral aspects asymmetrically situated near apical orifice.

**Distribution.**—(Fig. 38). India (Bihar, Orissa, Madhya Pradesh). Reported from Dehra Dun, Uttar Pradesh, with a questionable record from Karnataka (Heynes-Wood and Dover, 1928).

**Localities.**—INDIA: Bihar: 17 km S Hazaribagh, 600 m, 21.VI.1986, scrub forest (DLPC); 45 km N Ranchi, 21.VI.1986, scrub forest (DLPC); Orissa: Simlipal National Park, 24–25.VI.1986, forest path (DLPC); Madhya Pradesh: Kanha National Park, 14.VI.1982, forest path (DLPC, CMNH).

**Ecology.**—This species occurs in open scrubby habitat with bushes 2 to 5 m tall as well as along roads and openings in primary forest. Its adults appear soon after the pre-monsoon rains begin.

### *Cicindela (Ancyliia) andrewesi* (Horn)

*Calochroa andrewesi* Horn, 1894a:171, pl. 3, fig. 1.

**Type status.** Lectotype, female [here designated]. **Type labels.** "Canara" [handscript]; "Andrewes 94" [handscript]; "Type!, Dr. W. Horn" [typeset red label]; "Syntypus" [typeset red label]; "andrewesi Horn" [typeset]; "LECTOTYPE, *Calochroa, andrewesi* W. Horn, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 15.5 mm; anterior band extending from humeral angle medially and meeting oblique middle band; left hind tibia missing.] Paralectotype, female [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. [Three syntypes at both DEI (Döb-ler, 1973) and BMNH (G. G. Kibby, personal communication, 1983); unexamined.] *Type depository.*



Lectotype at DEI; paralectotype at BMNH. *Type locality*. "Nord-Canara" (North Kanara, Karnataka, India).

*Cicindela unica* Fleutiaux, 1895:245, new synonymy.

*Type status*. Syntype(s)? [unexamined; synonymy based on Walther Horn's statements by Fowler (1912) about its resemblances with the next name]. *Type depository*. Unrecorded. *Type locality*. "Inde." (India).

*Calochroa flavoguttata* Horn, 1895:359.

*Type status*. Holotype, female! [by monotypy]. *Type depository*. Holotype at DEI. *Type locality*. "Southwest coast of Southern India."

*Cicindela andrewesi mauritii* Horn, 1907a:23, new synonymy.

*Type status*. Syntype [unexamined; concept based on Fowler (1912)]. *Type depository*. ?MNHN (Maindron Collection). *Type locality*. "Ind. Merid. Occid."

*Cicindela (Ancylia) andrewesi* Horn: Rivalier, 1961:125.

*Cicindela (Callichroa) (sic) ceylonensis atricolor* Mandl, 1981a:12, new synonymy.

*Type status*. Holotype, male! [by original description]. *Type depository*. Holotype at MHNG. *Type locality*. "India, Mysore, Shimoga District, Agumbe Ghat, 2000 ft" (Karnataka, India).

**Diagnosis.**—Distinguished by the three oblique yellow to orange elytral maculae; glabrous genae; slender, glabrous pronotum.

**Description.**—*General habitus*. Body medium to large (13.5–16 mm); body form slender; dorsum black, head and pronotum shiny; elytra dull, three narrow, oblique yellow to orange spots; body shiny black to slightly metallic purple-green ventrally. *Head*. Entirely glabrous; vertex moderately rugose with parallel rugae near eyes extending onto frons; labrum entirely shiny black to slightly purple; medial carina present; five acute teeth subequal in length and six to eight submarginal setae. *Prothorax*. Pronotum slender with parallel sides on each sex, completely glabrous on most specimens, sparsely setose at lateral margin on a few others; proepisterna mostly glabrous on both sexes, female with only a few setae but male with more abundant erect setae along anterocoxal margin; prosternum glabrous. *Pterothorax*. Female mesepisterna broadly concave. *Elytra*. Surface dull, nearly impunctate, minutely granulate noncontrasting punctures basally; maculae varied; three narrow yellow to orange elongate spots in a line not touching lateral margin and projecting obliquely mesad, middle one oriented opposite to the others; apical spot smallest, although absent on some specimens; apex minutely microserrulate. *Abdomen*. First and fifth sterna completely glabrous on female, sparsely setose on male; remaining sterna sparsely setose laterally, completely glabrous medially on each sex. *Legs*. Trochanters shiny black, glabrous; femora, tibiae and tarsomeres shiny black to slightly metallic purplish green. *Male genitalia*. Aedeagus short stocky and uniformly wide for most of its length; abruptly tapering to a blunt rounded tip; flange in left lateral aspect short, that in right lateral aspect inconspicuous.

**Geographic variation.**—Specimens with only a short, oblique middle band have been referred to as *Cicindela unica* and those with small spots as *C. mauritii*; however, because the size, shape and presence of elytral maculae are varied within any given population, subspecies designations are questionable and not recognized by us.

**Distribution.**—(Fig. 38). Western Ghats of extreme southern Maharashtra and Karnataka, India; a dubious report from the Northwest Frontier Province, Pakistan (Heynes-Wood and Dover, 1928).

**Localities.**—INDIA: Karnataka: 15 km W Mudigere, 28.V.1985 (DLPC); 20 km SW Chikmagalur, 6.VI.1984, forest path (DLPC); 17 km E Dandeli, 12.VI.1984, forest path (DLPC); 20 km W Shimoga, 11.VI.1985, scrub forest floor (DLPC); Shimoga District, Agumbe Ghat, 615 m, V.1974 (CMNH). Maharashtra: 5 km W Ajra, 16.VII.1986, forest path (DLPC).

**Ecology.**—Adults, often active during heavy rainfall, occur along forested paths, in coffee plantations and along road cuts at elevations of 600 to 900 m.

*Cicindela (Ancyli) calligramma* Schaum

*Cicindela calligramma* Schaum, 1861:69, pl. 1B, fig. 1.

*Type status.* Lectotype, female [here designated]. *Type labels.* "41829" [handprinted]; "Type" [typeset orange label]; "calligramma, Schaum\*, Coll., Tranqueb. Schaum" [handscript large yellow label with black marginal line]; "LECTOTYPE, *Cicindela, calligramma* Schaum, by R.E. Acciavatti, '84" [typed and handprinted red label]. [Lectotype is 16 mm; both antennae broken; right front leg, left hind tibia and tarsus, and genitalia missing.] [Lectotype agrees with Schaum's illustration but possesses a complete humeral lunule narrowed apically and touching middle band where the latter bends apically.] [Only one of two other apparent syntypes! at MNHB is conspecific with the lectotype; the female specimen! labelled "41829" [typeset]; "Type" [typeset orange label] is actually *Cicindela guttata* Weidemann, but not a syntype of that species.] Paralectotype, male [here designated] labelled "Type" [typeset orange label]; "PARALECTOTYPE" [typed and handprinted red label; possesses a complete humeral lunule broadly joined to middle band near the suture, but otherwise agrees with the lectotype.] *Type depository.* Lectotype and paralectotype at MNHB. *Type locality.* "Tranquebar and Pondicherry" (Tamil Nadu, India).

*Calochroa kraatzi* Horn, 1894a:172, pl. 3, fig. 4 (preoccupied, Dokhtoureff, 1883:10).

*Type status.* Holotype, female! [by monotypy]. *Type depository.* Holotype at DEI. *Type locality.* "Nord-Canara" (North Kanara, Karnataka, India).

*Cicindela calligramma* Schaum: Fowler, 1912:414, fig. 178.

*Cicindela calligramma* var. *confluens* Fowler, 1912:414 (*nec* Beuthin, 1889:231), new synonymy.

*Type status.* Holotype [unexamined; however, from Fowler's (1912) statements this is only a variation of the nominal subspecies]. *Type depository.* ?HMO [presumed lost; Fowler (1912) stated "Type in the Oxford Museum" but inquiries at HMO have not produced the type]. *Type locality.* Specified only as "it occurs, apparently, with the type-form."

*Cicindela (Ancyli) calligramma* Schaum: Rivalier, 1961:125.

*Cicindela (Ancyli) calligramma* Schaum: Naviaux, 1984b:62, fig. 5-7.

*Nomenclatural note.*—Because we consider *Calochroa* a subgenus of *Cicindela* (*sensu lato*), *Calochroa kraatzi* Horn, 1894, represents a junior secondary homonym of *Cicindela kraatzi* Dokhtoureff, 1883 (Article 57, ICZN, 1985).

The following published name has been associated with this species: *signata-confluens* Chaudoir, 1865:38; however, because this species name was neither described nor figured, it is unavailable.

*Diagnosis.*—Distinguished by the setose genae; proepisterna nearly covered by sparse appressed and semierect setae from large punctures; middle elytral band transverse, varied from curved apically at middle of disc, to straight.

*Description.*—*General habitus.* Body medium to large (13.5–16 mm); body form moderately robust; head and pronotum shiny copper, greenish copper or green; elytra dull green or brown; three separate or fused whitish yellow lunules; body shiny metallic copper or greenish purple ventrally. *Head.* Labrum long with a broad medial carina, five acute teeth subequal in size and four to eight submarginal setae, anterior margin dark, remainder ivory; antennal scape often with several subapical setae besides primary one; eyes small not bulging; vertex entirely glabrous except for supraorbital setae (one or two multiple on a few specimens); frons with parallel rugae which extend onto vertex adjacent to eyes; vertex with moderately impressed rugae forming an irregular pattern medially; genae covered by long, sparse erect setae projecting ventrally. *Prothorax.* Pronotum transverse, much wider behind anterior transverse sulcus than in front of posterior sulcus; pronotal surface coarsely and irregularly rugose, mostly covered by sparse, semierect setae except on either side of medial line; proepisterna entirely covered by sparse semierect to appressed setae, most abundant ventrally; prosternum mostly glabrous (one or two setae on a few specimens). *Pterothorax.* Female mesepisternal coupling sulcus broadly grooved dorsoventrally. *Elytra.* Surface sculpturing with small punctures minutely granulate, not contrasting with background color; punctures deepest basally, impunctate apically; maculae whitish yellow, varied in size and shape; humeral lunule on some specimens divided, on others complete; on most specimens humeral lunule and basal dot fused; on a few specimens anterior maculae broadly fused with the middle band; middle elytral band transverse, on most specimens curved apically at

middle of disc, but straight on a few specimens; apical lunule separate; elytral apex finely microserulate; sutural spine small. *Abdomen*. Sterna metallic purple-green to copper with abundant decumbent white setae laterally, nearly glabrous medially. *Legs*. Trochanters brown to shiny black, glabrous; femora and tibiae metallic copper to green; tarsomeres metallic green to bronze. *Male genitalia*. Aedeagus short, stocky, widest at middle and tapering abruptly to a blunt rounded tip; flange in left lateral aspect halfway along length of short apical orifice, flange in right lateral aspect inconspicuous.

*Geographic variation*.—Specimens with broadly fused maculae have been named *Cicindela calligramma confluens*, but because they occur with the nominal subspecies, we treat these specimens as an aberration. However, one or more of the various patterns of elytral maculation tend to predominate in various populations throughout the range of this species, and with further study these may deserve recognition. The individuals found in the Eastern Ghats of northern Andhra Pradesh are consistently dark green with reduced maculation, thereby superficially resembling *Cicindela guttata*.

*Distribution*.—(Fig. 38). India (Karnataka, Tamil Nadu, Andhra Pradesh). Reported by Fowler (1912) from Kerala (Trivandrum District) and Naviaux (1984b) from Sri Lanka (Puttalam District).

*Localities*.—INDIA: Karnataka: 15 km N Bangalore, 12.VI.1983, forest path (DLPC); Bangalore, 12.V.1984 (DLPC); 12 km E Chikmagalur, 17.VI.1984, moist creek bed (DLPC); 10 km E Hoskote, 22.VII.1986, scrub forest (DLPC); Tamil Nadu: 12 km E Salem, 22.IX.1978 (DLPC); Coimbatore, 430 m, XI.1976 (CMNH); 25 km S Pollachi, 19.VI.1983, forest path (DLPC); 20 km S Pudukkottai, 24.IX.1986, scrub forest (DLPC); 80 km SE Salem, 350 m, 18.X.1987, scrub forest (DLPC); Andhra Pradesh: 57 km NW Hyderabad, 4.VII.1986, scrub forest (DLPC); 65 km W Waltair, 29.VI.1986, scrub forest (DLPC); 12 km N Elura, 17.VIII.1985, scrub forest (DLPC). SRI LANKA: Puttalam District: Palugassegama, 9.XI.1983 (Naviaux, 1984b).

*Ecology*.—This species occurs on the floor of secondary forests and shrubby areas; its adults are strong fliers. Naviaux (1984b) reported its presence in dry regions of Sri Lanka away from water among low sparse vegetation. Adult body size within local populations is extremely varied, most likely the result of the differences in food quantities larvae have eaten (Pearson and Knisley, 1985).

### *Cicindela (Ancyliia) ceylonensis* Horn

*Cicindela (Calochroa) ceylonensis* Horn, 1892a:87.

*Type status*. Lectotype, male [here designated]. *Type labels*. "Ceylon, Schlueter" [handscript]; "Type!, Dr. W. Horn" [typeset]; "Syntypus" [red typeset]; "LECTOTYPE, *Cicindela, ceylonensis* W. Horn, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 13 mm.] [Two other syntypes at DEI (Döbler, 1973); unexamined.] Paralectotype, female (BMNH), and paralectotype, male (IRSNB) each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository*. Lectotype at DEI; one paralectotype each at BMNH and IRSNB. *Type locality*. "Ceylon" (Sri Lanka).

*Cicindela ceylonica* (sic) Horn: Fleutiaux, 1892:117.

*Cicindela (Ancyliia) ceylonensis* Horn: Rivalier, 1961:125.

*Diagnosis*.—Distinguished by the anterior elytral stripe long and straight, originating near scutellum and reaching to middle of disc; middle elytral stripe obliquely transverse.

*Description*.—*General habitus*. Body medium to large (13–20 mm); body form moderately slender; head and pronotum dark copper (on some specimens copper-green) dorsally, slight purple-green reflections laterally; elytra velvety greenish black, anterior stripe and two oblique stripes medially; body black to purple ventrally. *Head*. Labrum long, five subequal teeth slightly projecting anteroventrally; five to eight submarginal setae; anterior half of labrum broadly darkened, posterior half ivory; genae sparsely setose on ventral half; frons slightly convex, numerous parallel rugae arranged vertically;

vertex coarsely and irregularly rugose except rugae mostly parallel adjacent to eyes; antennal scape with one subapical seta. *Prothorax*. Pronotal surface covered by dense, moderately irregular rugae which become parallel on other side of medial line and shallow at lateral margins; numerous dark, erect setae everywhere on disc (most abundant on anterior reflexed margin) except adjacent to lateral edge and posterior reflexed margin; anterior and posterior sulci moderately impressed; pronotum widest behind moderately constricted anterior sulcus, subparallel laterally; proepisterna glabrous except for sparse setae on ventral third; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus shallowly grooved, groove medial and slanting posteroventrally; mesepimeron covered by appressed setae; metepisterna glabrous except for a few setae near posteroventral margin. *Elytra*. Disc punctured by shallow contrasting green punctures; elytral maculae yellow to yellowish white; anterior stripe medially between humeral angle and scutellum, extending to middle; middle stripe obliquely transverse; apical stripe oriented same as anterior stripe; elytral apices uniformly rounded on each sex, sutural spine small; microsculptulations small. *Abdomen*. Moderately dense, appressed setae laterally on first five sterna. *Legs*. Trochanters pitchy black, glabrous; femora, tibiae and tarsomeres metallic copper-black, tinged purple and green. *Male genitalia*. Aedeagus moderately slender, gradually tapering to apex; small inconspicuous flange subapically on each lateral aspect near apical orifice.

*Distribution*.—(Fig. 38). Southeast Sri Lanka (Moneragala District).

*Localities*.—No specimens have been seen from specific localities. Fowler (1912) listed this species from Sri Lanka, Trincomalee District, Trincomali, and Moneragala District, Wellawaya; however, specimens from the former locality most likely represent *C. diversa* which we give species rank.

*Ecology*.—Habitat unrecorded but presumably adults occur in forests. It appears to have a restricted habitat preference because Naviaux (1984b, 1986) did not find *C. ceylonensis* despite his recent extensive collecting over much of Sri Lanka.

### *Cicindela (Ancylia) diversa* Horn, new rank

*Cicindela ceylonensis diversa* Horn, 1904:37, pl. 7, fig. 19.

*Type status*. Syntypes [one individual of each sex mentioned in the original description; unexamined; concept based on comparing original description with specimens! from Sri Lanka, Anuradhapura District, Wilpattu National Park, Panikka Wila, 1.XI.1977 at NMNH]. *Type depository*. Unrecorded; not at DEI (Döbler, 1973). *Type locality*. "Trincomalee" (Sri Lanka).

*Cicindela ceylonensis diversa* Horn: Fowler, 1912:415, fig. 179.

*Cicindela (Ancylia) ceylonensis diversa* Horn: Naviaux, 1986:59, fig. 1–3.

*Diagnosis*.—Distinguished by the short oblique anterior elytral stripe near scutellum but not reaching to middle of disc; middle elytral stripe arcuate, nearly touching both lateral and sutural margins.

*Description*.—*General habitus*. Body medium to large (15–20 mm); body form moderately robust; head and pronotum dark copper (on a few specimens copper-green) dorsally, purple and green reflections laterally; elytra velvety black (rarely greenish black), maculae narrow forming medial and oblique stripes, irregularly shaped apical spot; body black to violet-black ventrally. *Head*. Labrum long, five teeth at anterior margin, six to eight submarginal setae, anterior half dark, posterior half ivory; genae with sparse, erect setae; frons somewhat convex, numerous parallel rugae arranged vertically; rugae on vertex moderately coarse and irregular except parallel adjacent to eyes; antennal scape with one subapical seta. *Prothorax*. Pronotum covered by dense, moderately irregular rugae which are parallel on disc either side of midline; sparse erect setae most abundant on anterior reflexed pronotal margin, setae absent adjacent to lateral margins and on posterior reflexed margin; anterior and posterior transverse sulci of pronotum moderately impressed; pronotal shape widest behind moderate constriction of anterior sulcus, subparallel laterally; proepisterna glabrous except on ventral third; prosternum glabrous. *Pterothorax*. Female mesepisternal surface broadly concave, lacking a medial groove; mesepimeron covered by appressed setae; metepisterna glabrous. *Elytra*. Surface slightly granulate-punctate; punctures green, shallowly impressed; elytral maculae yellow to yellowish white; anterior medial stripe short, between humeral angle and scutellum, extending obliquely only onto basal third; middle stripe long and obliquely transverse, nearly touching lateral and sutural margins; anterior end of middle stripe often arcuate near sutural margin; apical spot short and irregular, located nearly at lateral margin; apices uniformly rounded on each sex; sutural spine small; microsculptulations small. *Abdomen*. Moderately dense, appressed white setae laterally on first five sterna. *Legs*. Trochanters pitchy black, glabrous; femora, tibiae and tarsomeres metallic copper-black, tinged purple and green. *Male genitalia*.

Aedeagus moderately bulky, truncated and abruptly tapering to a point; abrupt flange protruding subapically in left lateral aspect near apical orifice.

*Distribution.*—(Fig. 38). Northern Sri Lanka (Anuradhapura and Mannar districts).

*Localities.*—SRI LANKA: Mannar District: Wilpattu National Park, 0.8 km NE Cockmuttai, 20 m, 6, 7.X.1977 (NMNH); 0.8 km NE Kokmotte, 15 to 30 m, 5–8.X.1977 (NMNH); Anuradhapura District: Wilpattu National Park, Panikka Wila, bungalow, 1.XI.1977, malaise trap (NMNH). Naviaux (1986) reported its occurrence at Anuradhapura and Giritale, Sri Lanka.

*Ecology.*—Adults frequent low elevation (10 to 30 m) forests during October and November.

*Remarks.*—*Cicindela diversa* superficially resembles *C. ceylonensis*, but differs by the form of the female mesepisternal coupling sulcus, the male genital apex and elytral surface texture and maculae. Furthermore, *Cicindela diversa* is consistently larger and more robust than *C. ceylonensis*.

### Subgenus *Cicindela* (*Calochroa*) Hope

*Calochroa* Hope, 1838:11.

Type species.—*Cicindela octonotata* Wiedemann, 1823.

*Calochroma* Motschulsky, 1862:22.

Type species.—*Cicindela sexpunctata* Fabricius, 1775.

*Calostola* Motschulsky, 1862:22.

Type species.—*Cicindela assamensis* Parry, 1844.

*Calochroa* Hope: Rivalier, 1958:331.

*Diagnosis.*—*Cicindela* (*Calochroa*) species adults can be distinguished from those of other subgenera by: 1) the flagellum within the male genitalia outlining a series of curves which raise a sustained membrane encasing the right dorsal side of the inner sac; 2) their large to very large body size; 3) elytral maculae on adults of most species show a basal or humeral spot extended medially forming a large spot or elongated stripe (although these are reduced to small dots or missing altogether on certain species); 4) adults of most species with ventral body setae confined to certain sclerites; 5) trochanters on adults of most species lacking subapical setae.

This subgenus is heterogeneous because of the diversity observed in adult characteristics among species. For example, there is a progressive development in the complexity of the male flagellum throughout the subgenus from one species to another. The flagellum becomes more elongated and developed into complex curves so that the sustained membrane becomes larger and increasingly wraps around more of the right side of the inner sac. Furthermore, the species exhibit a wide diversity of external characters making it difficult to settle on features which unite them. The study of this diversity is beyond the scope of this review and would require examination of many species included in the subgenus found elsewhere in the Oriental biogeographic region.

*Included species.*—The following species of *Cicindela* (*Calochroa*) occur on the Indian subcontinent: *C. (C.) octonotata* Wiedemann, 1823; *C. (C.) flavomaculata* Hope, 1831, new rank; *C. (C.) sexpunctata* Fabricius, 1775; *C. (C.) whithillii* (Hope, 1838); *C. (C.) tritoma* Schmidt-Goebel, 1846; *C. (C.) assamensis* Parry, 1844; *C. (C.) octogramma* Chaudoir, 1852; *C. (C.) fabriciana* Horn, 1915; *C. (C.) bicolor* Fabricius, 1781; *C. (C.) hamiltoniana* Thomson, 1857; *C. (C.) discrepans* Walker, 1858; *C. (C.) lacrymans* Schaum, 1863.

Key to adults of *Cicindela* (*Calochroa*) species

1. Front and middle trochanters each with a single (on a few specimens double) subapical seta ..... *octonotata* Wiedemann
  - Front and middle trochanters without subapical setae ..... 2
- 2.(1.) (Elytral epipleura mostly unpigmented, testaceous especially basally ..... *tritoma* Schmidt-Goebel
  - Elytral epipleura entirely pigmented, often metallic ..... 3
- 3.(2.) Labrum short, transverse, longitudinal dimension not exceeding half transverse dimension; three labral teeth, small to minute, projecting anteriorly ..... 4
  - Labrum elongate, longitudinal dimension exceeding half transverse dimension; three to five labral teeth, moderate to large, projecting anteroventrally ..... 6
- 4.(3.) Pronotum setose at lateral margin, remainder glabrous ..... *sexpunctata* Fabricius
  - Pronotum entirely glabrous ..... 5
- 5.(4.) Antennal scape with one subapical seta; elytra green on disc, nearly immaculate ..... *whithillii* (Hope)
  - Antennal scape with two subapical setae; elytra black on disc with three medial spots ..... *flavomaculata* Hope, new rank
- 6.(3.) Trochanters unpigmented, pale testaceous ..... 7
  - Trochanters pigmented, dark metallic ..... 8
- 7.(6.) Labrum completely shiny purplish black; elytral with humeral and medial spots ..... *assamensis* Parry
  - Labrum shiny purplish black, two testaceous medial spots on most specimens; elytra with continuous medial stripe .. *hamiltoniana* Thomson
- 8.(6.) Terminal abdominal segments reddish orange ..... *bicolor* Fabricius
  - Terminal abdominal segments metallic blue, purple, or black ..... 9
- 9.(8.) Labrum partially metallic ..... 10
  - Labrum entirely nonmetallic ..... 11
- 10.(9.) Large humeral elytral spot absent (a minute humeral dot present on a few specimens); three large orange medial spots separated; female mesepisternal coupling sulcus broadly concave; labrum only slightly raised at middle ..... *fabriciana* Horn
  - Large humeral elytral spot present; three large yellow-orange medial spots joined on some specimens; female mesepisternal coupling sulcus narrowly grooved; labrum raised to form medial carina ..... *octogramma* Chaudoir
- 11.(9.) Apical elytral spot nearly touching lateral margin; elytra dull black; prosternum densely setose posterior to procoxae ..... *discrepans* Walker
  - Apical elytral spot medial; elytra copper-green to brown; prosternum sparsely setose posterior to procoxae ..... *lacrymans* Schaum

*Cicindela* (*Calochroa*) *octonotata* Wiedemann

*Cicindela octonotata* Wiedemann, 1819:168.

*Type status.* Lectotype, male [here designated]. *Type labels.* "Mus. Westerm." [typeset]; "♂" [printed small square]; "Type" [red typeset]; "Bengal sw. 1809 octonotata Wied." [handscript]; "Zool. Museum, DK Copenhagen" [typeset]; "LECTOTYPE, *Cicindela*, *octonotata* Wied., by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 22 mm.] Paralectotypes, three females, each [here

designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository*. Lectotype and three paralectotypes at ZMUC. *Type locality*. "Bengalia."

*Calochroa octonotata* (Wiedemann): Rivalier, 1961:125.

*Calochroa octonotata* (Wiedemann): Naviaux, 1985:57, fig. 4, 46, 77.

*Nomenclatural note*.—The following published name has been associated with this species: *solonotata* Gistel, 1837:27; however, because it was neither described nor figured, it is unavailable.

*Diagnosis*.—Distinguished by the very large, brilliantly colored body; three large yellow elytral maculae; one subapical seta on each front and middle trochanteral segment.

*Description*.—*General habitus*. Body very large (20–25 mm); dorsum brilliantly colored with deep velvety purple-blue and metallic green contrasting with bright copper-red areas medially on head and pronotum; large yellow maculae on elytra; body metallic green, copper-red and purple ventrally. *Head*. Labrum extremely long wedge-shaped; broad medial carina; five marginal teeth, middle one very long, others much smaller, lateral two acute, other two rounded; six to eight submarginal setae; anterior and basal margins dark, remainder ivory; head glabrous except for sparse scattered semierect setae ventrally on genae; frons and vertex finely rugose; eyes moderately projecting; antennal scape glabrous except for primary seta. *Prothorax*. Pronotal surface alutaceous, shape subquadrate, transverse sulci deeply impressed, each posterior pronotal angle with a large, rounded projection, medially convex, bulging; proepisterna almost covered by sparse, long, appressed and erect setae except on a small posterodorsal area; prosternum glabrous. *Pterothorax*. Female mesepisterna broadly concave. *Elytra*. Surface minutely granulate; disc dull velvety purple-blue; shiny metallic copper near scutellum, along suture, at apex, and metallic green along entire lateral margin; small, yellow humeral spot and three larger, yellow spots transversely arranged at equal intervals along elytra; apex slightly and separately rounded on each sex and microsculptate; sutural spine moderately long. *Abdomen*. Sterna laterally covered by abundant appressed setae, medially glabrous. *Legs*. Trochanters shiny purple-black, one subapical seta on each front and middle segment; femora metallic copper, green and purple; tibiae and tarsomeres purple. *Male genitalia*. Aedeagus large, moderately slender, widest at middle and tapering gradually toward apex; apex displaced slightly to the right, broadly rounded and elongated at tip; apical orifice extends along distal half; subapical flange absent; elongated concavity below apex with sclerotized edges extending for one-quarter of entire aedeagus length; parameres extending only half the entire aedeagus length.

*Distribution*.—(Fig. 38). India (Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Sikkim, Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Assam) through Nepal and Bangladesh into Burma.

*Localities*.—INDIA. Bihar: Pusa, 2.VIII.1916 (DLPC); West Bengal: 25 km N Siliguri, 3.VI.1985, gravel river beach (DLPC); Uttar Pradesh: Rishikesh, Ganga River, VII.1986 (KWC, CMNH); Arunachal Pradesh: Kameng Frontier Division, Bhairabkundi, 215 m, 20–21.V.1961 (JSC, CMNH). NEPAL: Chitwan District: Chitwan Road at Lothar River, IX.1971 (CMNH); Lothar near Birganj, 140 m, 12.IX.1972 (CNCO).

*Ecology*.—Adults occur principally on the gravel and sand banks of streams, but during the monsoons they also move to the open floor of nearby forests. Fowler (1912) reported adults from stony river beds, argillaceous river banks and on sandy banks of jungle streams. Naviaux (1985) mentioned adult flight as rapid and lofty, but often returning individuals close to the same spot; however, they were difficult to capture among the pebbles and ground debris.

### *Cicindela (Calochroa) flavomaculata* Hope, new rank

*Cicindela flavomaculata* Hope, 1831:21.

*Type status*. Syntype(s)? [unexamined; concept based on specimens! labelled "Nepal, Amelkhanj, 520 m, 30.VII.1957" at CMNH]. *Type depository*. Unknown [previously reported as missing by Horn



(1898a:193) and now presumed lost (G. G. Kibby, personal communication, 1984)]. *Type locality*. "Nepal."

*Calochroa sexpunctata* (Fabricius): Rivalier, 1961:125.

*Calochroa sexpunctata* (Fabricius): Naviaux, 1985:57, fig. 6, 48, 79.

*Nomenclatural note*.—While the specimen upon which Hope based his description apparently no longer exists, Hope (1840) made it quite clear that he was familiar with *C. sexpunctata* Fabricius, and regarded his *C. flavomaculata* as a variety of that species. However, Hope, like most authors, erroneously called this species *C. sexpunctata* Fabricius, but because their concept of *C. sexpunctata* Fabricius is invalid (see discussion under *C. sexpunctata* Fabricius), the next available valid name must prevail according to the Code (Article 49) (ICZN, 1985).

The following published names have been associated with this species: *tripunctata* Dejean, 1837:2; *risi* Schmidt-Goebel, 1846:4; *sexsignata* Chaudoir, 1865:38; however, because none of these were described or figured, they are unavailable.

*Diagnosis*.—Distinguished by the velvety black to greenish black elytra; three white elytral spots along midline; short, transverse labrum; entirely glabrous pronotum.

*Description*.—*General habitus*. Body medium to large (13.5–16 mm); dorsum dull, dark, velvety black to greenish black on most specimens (blue dorsally on a few specimens) with metallic green to blue lateral margins; elytra with three spots arranged medially one behind the other; body ventrally metallic purple and blue-green. *Head*. Labrum very short, transverse, three small acute teeth at middle on anterior edge, shiny black except for two large ivory areas on each side of middle; six to eight submarginal setae; surface sculpturing of head fine, rugae parallel; head entirely glabrous; eyes moderately protruding; antennal scape glabrous except for one or two primary setae. *Prothorax*. Pronotal shape quadrate, lateral sides parallel, posterior angles wide with separate, rounded bulges; entirely glabrous; pronotal disc finely and irregularly rugose, rugae becoming coarser and more noticeable laterally; proepisterna smooth, polished, and glabrous except for a small area of semierect setae along anteroventral margin; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a groove slanting posteroventrally and deepest at middle along posterior margin. *Elytra*. Surface sculpturing nearly impunctate and dull black except for bright metallic green or blue margins; three yellow-white spots arranged on a longitudinal line on elytra; coarsely microserulate; apical margin tapering obliquely from outer apical angle then abruptly rounded at suture; sutural spine small. *Abdomen*. Anterior five sterna with sparse appressed white setae near extreme lateral margin on each sex; last sternum completely, and remaining sterna medially, glabrous. *Legs*. Trochanters shiny black, glabrous; femora metallic green; tibiae and tarsomeres purple. *Male genitalia*. Aedeagus small, slender, widest at base of apical orifice; tapering uniformly to a blunt apex; small sclerotized beak; slightly raised and elongate flange present in left and right lateral aspects below apex; parameres extending for two-thirds of aedeagus length.

*Distribution*.—(Fig. 40). Generally occurring throughout the Indian subcontinent eastward into Southeast Asia and the Philippines.

*Localities*.—NEPAL: Amelkhanj, 520 m, 30.VII.1957 (CMNH); Birganj, Parwanipur, IX.1971 (CMNH); Janakpur, 18.XI.1970 (CMNH); Tanje, Himalchula, X.1980 (CMNH); Morang, Biratnagar, 140 m, 21.V.1980 (JPC). INDIA: Haryana: 10 km S Chandigarh, 26.VII.1982, grassland (DLPC); Uttar Pradesh: Muzaffarnagar, 8.VII.1982 (DLPC); Naini Tal, 19.IX.1986, night light (DLPC); Punjab: 17 km S Rajpura, 27.VII.1982, grassland (DLPC); Union Territory: New Delhi, Tari, 3.II.1957 (DLPC); Madhya Pradesh: Pachmarhi, Satpura Hills, 1075 m, X.1970 (CMNH); Karnataka: Coorg District, Tithimatti, 30.VII.1940 (DLPC); Coorg District, Mercara, 1230 m, V.1973 (CMNH); 35 km S Hunsur, 24.VI.1984, grassy meadow (DLPC); 5 km N Mudigere, 5.VI.1984, forest path (DLPC); 7 km E Sulya, 4.VI.1984, road cut (DLPC); Sringeri, 650 m, 8.VI.1987, night light (DLPC); Mudigere, 950 m, 7.VI.1987, rice paddy (DLPC); Nagarhole National Park, 24.VI.1985, grassy meadow (DLPC); Balehonnur, 10.VI.1985, night light (DLPC); 2 km NE Kodlipet, 18.XI.1984 (DLPC); Bihar: 85 km W Ranchi, 23.VI.1986, scrub forest (DLPC); 40 km S Palamau, 22.VI.1986, sandy river edge (DLPC);



West Bengal: Calcutta, 17.VI.1986, night light (DLPC); Midnapar District, Kargpur (CMNH); Kancharapara, 10.VI.1944 (CMNH); Assam: Jorhat, 10.IX.1983, night light (DLPC).

**Ecology.**—Adults occur most commonly on grassy meadows and rice paddies, but also on open forest floor and sandy river banks. Adults are active even during rainstorms and are commonly attracted to lights at night. Frequently the adults climb to the top of grass stems to escape predation. They are regularly associated with *C. whithillii* (Hope) on rice paddy bunds during September through October. Stebbing (1908) and Fowler (1912) have reported this species as a predator on the rice sapper plantbug, *Leptocoris acuta*, a pest of cultivated rice.

### *Cicindela (Calochroa) sexpunctata* Fabricius

*Cicindela sexpunctata* Fabricius, 1775:226.

**Type status.** Lectotype, male [here designated]. **Type labels.** “6 puncta, ta” [handscript]; “LECTOTYPE, *Cicindela, sexpunctata* Fabr., by R.E. Acciavatti, '83” [typed and handprinted red label]. [Lectotype is 14 mm; antennae broken, only scapes remaining.] Paralectotype, male [here designated] labelled “PARALECTOTYPE” [typed and handprinted red label; pinned through the left elytron]. **Type depository.** Lectotype and paralectotype at ZMUC. **Type locality.** “Malabar Coast” (Kerala, India).

*Cicindela aurovittata* Audouin and Brullé, 1839:127, pl. 8, fig. 3, new synonymy.

**Type status.** Syntype(s)? [unexamined; concept based on specimens! from Sri Lanka at CMNH]. **Type depository.** ?MNHN. **Type locality.** “Pondicherry” (Union Territory, India).

*Cicindela sexpunctata aurovittata* Audouin and Brullé: Schaum, 1863:62.

*Calochroa aurovittata* (Audouin and Brullé): Rivalier, 1961:125.

*Calochroa aurovittata* (Audouin and Brullé): Naviaux, 1984b:73, fig. 60–62.

**Nomenclatural note.**—Lectotype and paralectotype of *Cicindela sexpunctata* are not conspecific with the species discussed by Fowler (1912) and thought by previous workers to be *Cicindela sexpunctata* Fabricius (*sensu* Horn, 1915); on the contrary, they are conspecific with *C. aurovittata* Audouin and Brullé. The specific name, *Cicindela sexpunctata* Fabricius, which was used for these erroneous designations cannot be retained for the species to which the name was wrongly applied (Article 49, ICZN, 1985).

**Diagnosis.**—Distinguished by the medium-sized dark body; three elytral spots in a row; short transverse labrum; setose lateral margin of the pronotum.

**Description.**—**General habitus.** Body medium (12–14 mm); head and pronotum dark, dorsally shiny bronze, laterally metallic green; pronotum laterally setose; elytra velvety black on disc with metallic copper or green margins and three yellow-white spots arranged in a longitudinal line; body metallic purple and green ventrally. **Head.** Labrum short, transverse with four to six submarginal setae and three small, acute teeth near middle of anterior margin; medially with a narrow raised line, mostly black except for a central ivory area which extends across middle; antennal scape glabrous except for a subapical, primary seta; surface sculpturing of head with moderately impressed rugae forming fine, parallel ridges on frons near eyes and extending medially, rugae wavy behind eyes. **Prothorax.** Pronotal shape subquadrate, surface sculpturing moderately rugose with coarse wavy ridges on anterior reflexed margin and at middle, but irregular on either side of middle, lateral margin with one row of sparse, decumbent white setae originating from large setigerous punctures; proepisterna smooth, polished and glabrous except for setae ventrally at, and anterior to, coxal margin; prosternum glabrous. **Pterothorax.** Female mesepisternal coupling sulcus a short elongate groove at middle near posterior margin. **Elytra.** Surface sculptured with tiny punctures each with a minute granule; disc dull, black with noncontrasting punctures, laterally punctures green and contrasting with shiny copper or green metallic margins which extend broadly from humeral angle to suture; maculae as three oval spots of equal size arranged medially one behind the other on disc; apex coarsely microserulate with a minute sutural spine. **Abdomen.** Sterna with small areas of sparse decumbent setae laterally, medially glabrous. **Legs.** Tro-

chanters shiny black and green, glabrous; femora metallic green and purple; tibiae and tarsomeres purple. *Male genitalia*. Aedeagus small, moderately slender and of a uniform width from middle to apical orifice; abruptly tapering apically to a blunt tip; a long slightly raised flange in left and right lateral aspects extending a short distance proximally from apex; both flanges opposite apical orifice.

*Distribution*.—(Fig. 40). Reaches the western limit of a wide Indo-Malaysian distribution in Sri Lanka and India (Tamil Nadu, Andhra Pradesh, Orissa, West Bengal). Although the type locality of this species is along the southwest coast of India, its presence there is doubtful; the lectotype was more likely collected along the southeastern coast of India.

*Localities*.—SRI LANKA: Sigirya, 30.X.1960 (CMNH); Puttalam District: 8 km NNE Puttalam, 1.II.1962, at light (CMNH); Puttalam, 1, 4.V.1981 (RNC, CMNH). INDIA: Tamil Nadu: Pitchararam Island, 25.IX.1980 (DLPC); Andhra Pradesh: Kolleru Lake, 18.VIII.1985, moist grass (DLPC).

*Ecology*.—Naviaux (1984b) found this species associated with large stagnant ponds in alkali soils, sometimes in company with *Cicindela* (*Lophyridia*) *angulata* and *C. (Myriochile) distinguenda*.

### *Cicindela (Calochroa) whithillii* (Hope)

*Calochroa whithillii* Hope, 1838:23.

*Type status*. Lectotype, male [here designated]. *Type labels*. "whithillii Hope" [handscript]; "Not in Gem. e Har. Cat., W.H." [handscript]; "TYPE COL; 9, Calochroa whithillii Hope, Hope Dept. Oxford" [typeset and handprinted]; "LECTOTYPE, Calochroa, whithillii Hope, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 14 mm; blackish green elytra; all tarsomeres missing except left front one; specimen had been pinned previously through left elytron.] Paralectotype, male, labelled "287" [typeset]; "whithilli, Hope\*, Bombay. Hope., Madras. Ind." [handscript large yellow label; thin black border], and paralectotypes, two females, unlabelled, each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository*. Lectotype at HMO; three paralectotypes at MNHB. *Type locality*. "vicinity of Bombay" (Hope mentioned specimen originated from the Concan (Konkan), the coastal region of Maharashtra, India).

*Cicindela whithilli* (sic) Hope: Dohrn, 1881:310.

*Cicindela whithillii* (sic) Hope: Dohrn, 1889:172.

*Calochroa whithilli* Hope: Rivalier, 1961:125.

*Diagnosis*.—Distinguished by the medium to large, uniformly green to blue body; nearly immaculate elytra.

*Description*.—*General habitus*. Body medium to large (13.5–18 mm); body elongate; head and pronotum green, blue-green to blue; elytra dull green, blue-green or blackish green, lateral margins and suture shiny green; elytra immaculate except for one small dot medially on middle third; body ventrally metallic green. *Head*. Labrum short, transverse on male and somewhat more elongate on female; medial carina narrow; completely shiny green, blue-green or blackish green with six submarginal setae; three anterior teeth flanked by two rounded bulges; frons and vertex moderately rugose; genae glabrous. *Prothorax*. Pronotum entirely glabrous, subquadrate, posterior angles prominent; pronotal surface coarsely rugose, ridges parallel and transverse except for wavy rugae on each side of midline; propisterna smooth except for parallel wrinkles dorsally, almost entirely glabrous except for semierect setae ventrally near coxal margin; prosternum glabrous, ridges transverse. *Pterothorax*. Female mesepisternal coupling sulcus a groove deepest medially, broadened ventrally. *Elytra*. Granulate on disc, punctate laterally; immaculate except for a minute white dot on each elytron at about its middle at interface of dull disc and shiny lateral margin; apex coarsely microserulate and cojointly rounded on each sex with a minute sutural spine. *Abdomen*. First four sterna with sparse decumbent setae laterally on female, first five similar on male; all sterna glabrous medially on each sex. *Legs*. Trochanters shiny black, glabrous; femora metallic green and purple; tibiae and tarsomeres purple. *Male genitalia*. Aedeagus small, slender, uniform width for most of the proximal half; abruptly tapering to blunt tip; sclerotized beak on right set off from apex by a small notch; subapical flange inconspicuous and only in left lateral aspect.

*Distribution.*—(Fig. 39). Western Ghats in southern India (Maharashtra, Karnataka, Kerala, Tamil Nadu).

*Localities.*—INDIA: Karnataka: Mercara, 15.X.1983, rice fields (DLPC); Sringeri, 8.VI.1987, night light (DLPC); Kumta, 50 m, 12.VI.1987, forest path (DLPC); Chikmagalur, 1230 m, V.1982 (CMNH); Tamil Nadu: Anaimalai Hills, Cinchona, 1075 m, V.1976 (CMNH); Anaimalai Hills, Kadamparai, 1075 m, V.1963 (CMNH); Kerala: Kottayam District, Peermade, V.1975 (CMNH).

*Ecology.*—Adults of this species occur on forested mountain roads from June to September and are abundant in rice paddies during October in Karnataka. Fowler (1912) discussed its presence in rice paddies with *Cicindela flavomaculata* Hope during June. Other habitats he mentioned included sandy roads at 925 to 1230 m in the Anaimalai Mountains and along dusty roads at 1075 to 1846 m in the Nilgiri Mountains of Tamil Nadu, as well as near rivers in Karnataka.

*Cicindela (Calochroa) tritoma* Schmidt-Goebel

*Cicindela tritoma* Schmidt-Goebel, 1846:3, pl. 1, fig. 3.

*Type status.* Holotype, male [by monotypy; examined by J. Probst (personal communication, 1988) at our request and compared with a male specimen! sent to him and returned to CMNH for reference]. *Type labels.* “Typus! Teste, Dr. Obenberger” [printed red label]; “Birma, Helfer” [handwritten]; “Mus. Pragense, Coll. Dr. Helfer” [printed]; “Cicindela tritoma, Schm. G. Unicum Typus teste me! 1920, Det. Dr. Obenberger” [handwritten, ‘Typus’ underlined]. [Holotype is 13.5 mm with portions of front and middle legs missing.] *Type depository.* Holotype at NMP. *Type locality.* “Burma.”

*Diagnosis.*—Distinguished by the medium to large, black body; elytral maculae yellow-orange, elongate and medial; elytral epipleura unpigmented and testaceous.

*Description.*—*General habitus.* Body medium to large (14–17 mm); head and pronotum dorsally black, lateral margins blue-green and purple; elytra dull black, yellow-orange maculae; body purple ventrally, green tinged. *Head.* Labrum short, testaceous, black margins broad; four submarginal setae; abruptly raised medial carina; anterior margin tridentate; middle tooth abruptly bent forward creating a small medial depression or flattened area obliquely ridged on either side at anterior margin; tooth on each side of middle projecting ventrally; broadly acute projection on each lateral labral margin; vertex with numerous slightly raised rugae, parallel behind eye, arcuate near front of eye, wavy and irregular medially; eyes not prominent. *Prothorax.* Pronotum subquadrate, widest behind anterior transverse sulcus, sides slightly rounded and sloping inward toward posterior transverse sulcus; anterior and posterior margins straight on male with anterior reflexed margin narrow moderately impressed; anterior and posterior margins slightly arcuate at center on female, anterior reflexed margin wide; anterior and posterior transverse sulci shallowly impressed; pronotal surface entirely glabrous, moderately to finely rugose, rugae somewhat parallel medially and laterally but irregular and wavy on disc; proepisterna purple, entirely glabrous on female, but with a small patch of erect setae near coxal margin on male; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a broad posteriorly slanting groove, often with a small, circular depression at middle of groove; female metepisterna and mesepimera almost totally glabrous except for a few sparse setae near ventral margin; male metepisterna has a setal patch at posteroventral margin and mesepimera covered by appressed setae; metasternum with a large lateral area of appressed setae on both sexes. *Elytra.* Noncontrasting purple-black punctures on disc, impunctate apically; moderately punctate laterally and on basal half, finely punctate medially on apical half; elytral maculae yellow-orange; basal dot greatly expanded into a sinuate basal stripe between humeral angle and scutellum; basal dot transversally encompassing humeral angle but extending only halfway to scutellum, longitudinally extending along middle of disc obliquely toward suture, bending slightly toward lateral margin, ending on basal third of elytra; two oval spots in a row medially with anterior one laterally situated, apical one nearly touching suture; lateral epipleural surface unpigmented, testaceous brown; apical margins cojointly and uniformly rounded on each sex; minute microscerrulations only near suture; sutural spine minute to nonexistent. *Abdomen.* Sterna on most female specimens totally glabrous, a few specimens with several appressed setae on third sternum laterally; sterna on male specimens laterally with patches of sparse appressed setae on first three, but most abundant on third sternum, remaining male sterna glabrous except for four to six long erect primary setae on third to fifth. *Legs.* Coxae metallic green, abundant appressed

setae; trochanters reddish testaceous, glabrous; femora metallic green; tibiae and tarsomeres metallic purple-black. *Male genitalia*. Aedeagus expanded at middle; apex blunt; medial flange short, narrow, slightly raised and halfway between expansion and apex only in left lateral aspect.

*Distribution*.—(Fig. 39). Eastern borders of India (Nagaland) and Bangladesh (Chittagong Hill Tracts) into northern and western Burma.

*Localities*.—INDIA: Assam: Chakong Khunua, 370 m, 25.VII.1961 (CMNH). BANGLADESH: Chittagong Hill Tracts: Dulahazara, 18.V.1965 (NMNH). BURMA: Kachin State: Teinzo, V.1886 (MCSNG, DEI); Chin State: Chin Hills, Mount Victoria, 1000 m, VI.1938 (BMNH).

*Ecology*.—The habitat of this species is unrecorded but presumably adults are found in forest openings.

### *Cicindela (Calochroa) assamensis* Parry

*Cicindela assamensis* Parry, 1844:454.

*Type status*. Lectotype, male [here designated]. *Type labels*. "Assam" [handprinted white circular label]; "F. Bates Coll., 1911-248" [typeset]; "Cicindela, Assamensis, c.T. Parry" [handprinted large rectangular label]; "LECTOTYPE, Cicindela, assamensis Parry, by R.E. Acciavatti, '84" [typed and handprinted red label]. [Lectotype is 18 mm; both antennae broken and right front tarsomeres missing; pronotum and right middle tarsomeres have been repaired with glue.] Paralectotype, male [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. [Both syntypes agree with the illustration Parry (1848) presented for this species which he had previously described.] *Type depository*. Lectotype and paralectotype at BMNH. *Type locality*. "Assam" (India).

*Cicindela (Calochroa) assamensis* Parry: Parry, 1848:80, Pl. II, fig. 1.

*Cicindela horsfieldii* Thomson, 1857b:325.

*Type status*. Syntype [unexamined; synonymy follows Horn (1926)]. *Type depository*. Unknown [the unique syntype at BMNH was last reported by Horn (1898a); recent inquiries at BMNH (M. J. D. Brendell, personal communication, 1985) failed to locate the syntype]; presumed lost. *Type locality*. Unspecified in original description.

*Calostola assamensis* (Parry): Motschulsky, 1862:22.

*Calochroa assamensis* (Parry): Rivalier, 1961:127.

*Diagnosis*.—Distinguished by large, greenish black body; two yellow elytral spots; shiny purplish black labrum with five large teeth; glabrous and reddish testaceous trochanters.

*Description*.—*General habitus*. Body large (18–20 mm); head and pronotum dorsally greenish black, laterally purple; elytra dull, dark greenish black and purple with two large yellow elytral spots; body shiny purplish green ventrally. *Head*. Glabrous, finely rugose on vertex; greenish black dorsally and purple laterally; frons meeting vertex at an abrupt angle; vertex quite flattened between eyes; labrum large, broadly convex, shiny black; five anterior and two lateral teeth; four to six submarginal setae; antennal scape with one subapical seta. *Prothorax*. Pronotum glabrous, finely rugose, cylindrical and parallel sided; proepisterna glabrous except for a few scattered setae at coxal margin. *Pterothorax*. Female mesepisterna broadly concave. *Elytra*. Elongate, parallel sided; dull black-green; moderately large yellow humeral spot and a much larger oval one nearly touching lateral margin at the middle of each elytron and extending onto disc beyond middle; elytral apex uniformly and cojointly rounded on each sex with minute, inconspicuous microsculptulations at margin. *Abdomen*. All sterna glabrous on each sex. *Legs*. Trochanters reddish testaceous, glabrous; femora, tibiae and tarsomeres metallic purple and green. *Male genitalia*. Aedeagus short, bulky, widest at middle; distally slightly constricted before expanding to nearly the same width as middle, then abruptly tapering to a broad truncated tip; subapical flange absent.

*Distribution*.—(Fig. 39). Northeastern India (Sikkim, West Bengal, Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Assam) and Bangladesh into Burma.

*Localities*.—INDIA: West Bengal: 15 km N Siliguri, 250 m, 3.VI.1985, forest path (DLPC, CMNH); Assam: Laigarong, 310 m, 26.X.1960 (JSC); Kumaon, Maupata, 1385 m, 2.IX.1960 (JSC); Meghalaya: Shillong (MCZC).

*Ecology.*—Adults occur commonly on the floor of shaded forests with dense undergrowth; when disturbed, they fly up to land on leaves of this low vegetation. Fowler (1912) reported this species abundant along sandy jungle streams rather than within the jungle forest.

*Cicindela (Calochroa) octogramma* Chaudoir

*Cicindela octogramma* Chaudoir, 1852:4.

*Type status.* Lectotype, female [here designated]. *Type labels.* “288” [typeset]; “octogramma, Chaud.\*, Ind. Or. Chaud.” [handscript on large yellow label; thin black border]; “LECTOTYPE, *Cicindela octogramma* Chaudoir, by R.E. Acciavatti, '84” [typed and handprinted red label]. [Lectotype is 13.5 mm; right hind tibia missing.] *Type depository.* Lectotype at MNHB. *Type locality.* “Le Nord de l'Hindostan, pres de Dinapoor” (Dinapur, India).

*Cicindela octogramma* Chaudoir: Fowler, 1912:404, fig. 173.

*Calochroa octogramma* (Chaudoir): Rivalier, 1961:127.

*Cicindela octogramma labionigra* Mandl, 1965:71.

*Type status.* Holotype, female! [by original description]. *Type labels.* “NEPAL, Sun Khosi Tal, 2150 m 2.V.62, leg. G. Ebert” [typeset]; “Holo-Typus, *Cic. octogramma*, ssp. *labionigra* m, 1964, det. K. Mandl” [handprinted except typeset ‘Typus’ on orange side of label]. [Female allotype!, three paratypes! labelled the same.] *Type depository.* Holotype, allotype and paratypes at ZSBS. *Type locality.* “Sun Khosi Tal, Nepal.”

*Nomenclatural note.*—Mandl (1965) characterized four typical aberrations in terms of their elytral maculae. He apparently intended to formally name these aberrations; however, his use of Latin quadrinomials even with a description falls outside the procedures of the Code (Article 5b, ICZN, 1985), thereby making his aberrational names unavailable. We consider all of these aberrations to fall within the range of variation exhibited by *C. octogramma labionigra*.

*Diagnosis.*—Distinguished by the dull black elytra with four yellow to orange maculae, one of which occupies the humeral angle; metallic black to green labrum with five large teeth; trochanters glabrous, dark pitchy black, metallic tinged.

*Description.*—*General habitus.* Body medium (12–15 mm); body dorsally black; head and pronotum laterally, and thorax and abdomen ventrally, shiny purple, green and copper; elytra dull black, yellow or orange spots (separate on most specimens, fused on a few) arranged in a line on each elytron; body ventrally shiny black often slightly purple tinged. *Head.* Five moderately large labral teeth, lateral four coequal in length, middle one longest on female, shortest on male; six submarginal setae; medial carina evident; male right mandible with posteriorly projecting tooth; vertex shiny black to bright copper dorsally, iridescent red, green and purple laterally; numerous moderately raised longitudinal rugae adjacent to eyes extending onto frons, arcuate at middle and irregular posteriorly. *Prothorax.* Pronotum subquadrate, anterior and posterior transverse sulci deep; disc black to bright copper; extreme lateral margins with metallic green, copper or purple reflections, on a few specimens these extend into transverse sulci; lateral margin with sparse setae, disc uniformly and moderately rugose; proepisterna purple to purple-green, glabrous except for long, sparse setae on anterior and coxal third. *Pterothorax.* Female mesepisternal coupling sulcus a deep medial groove; pleura sparsely setose, metallic purple dorsally grading into black ventrally. *Elytra.* Surface minutely granulate-punctate on disc; shallow minute blue-green punctures basally, nearly impunctate (on some specimens noncontrasting punctures) apically; base slightly metallic green on adults of the nominal subspecies of *Cicindela octogramma* and dull black on those of *C. octogramma labionigra*; most specimens with a yellow humeral spot (a complete humeral lunule on some specimens) and three larger spots arranged in a line, any or all of which may be joined (on a few specimens an apical crescent extends from expanded apical spot) to suture; apex with small microserrulations. *Abdomen.* First five sterna, sparsely appressed setae laterally, glabrous medially. *Legs.* Trochanters dark pitchy black, metallic tinged, glabrous; femora metallic blackish green; tibiae and tarsomeres metallic purple. *Male genitalia.* Aedeagus bulky, widest beyond middle tapering abruptly to a truncated apex; apical orifice not reaching apex; a long, slightly raised flange extends basad from apex in left and right lateral aspects.

*Geographic variation.*—We recognize two subspecies of *Cicindela octogramma* at present. Certain specimens of subspecies *Cicindela octogramma labionigra* from

central Nepal have a black labrum with slight green reflections; head and pronotum are predominantly black with slight green reflections. Otherwise they do not differ significantly from Yunnan, China, specimens representing the nominal subspecies. However, because specimens with darkened heads and minimal copper or green coloring predominate in central Nepal, we recognize *Cicindela octogramma labionigra*. Additionally, elytral maculae of central Nepal specimens are varied in size and shape within a given population whereas elytral maculae are more consistent in size and shape for Yunnan specimens.

*Distribution.*—(Fig. 39). *Cicindela octogramma octogramma* are known from northern India (Himachal Pradesh, Uttar Pradesh, West Bengal, Assam), and Nepal, eastward into Burma, Laos and Yunnan, China. *Cicindela octogramma labionigra* occurs in the Kathmandu and Sun Kosi River valleys of central Nepal.

*Localities.*—*Cicindela octogramma octogramma*. CHINA: Yunnan: See-Tsong, 2000 m (IRSNB); Nord Ouest Yunnan, Djo-Kuo-La, 1200 m (IRSNB); *Cicindela octogramma labionigra*. NEPAL: Kathmandu Valley, Sundarjal, 1845 to 2300 m, 2.VII.67, pastures (CNCO); Sundarjal, 2460 m, 3.VII.67, oak forest (CNCO); Gulu Bhanjyang, 2300 to 2615 m, 2.VII.67, pastures (CNCO); Myagdi District: Dhawalagiri, Ghara Khola, Shikka-Tatopani, 1100 to 2000 m, 13.VIII.1986 (JPC, CMNH); Nawakot District: Kakni, 2150 m, V.1972 (CMNH); Chautara District: Pati Bhanjyang, 1845 to 2300 m, 12.V.67, pastures (CNCO); Helambu, 3385 m, 7.VI.67 (CMNH); Ramechap District: Janakpur Giri, Mount Hanumanti, 2800 m, 21.V.1980 (CMNH); Dhading District: west of Samari Banjyang and Topal Khola, 1000 to 1200 m, 23.VII.1983, cultivated land (SMFM).

*Ecology.*—Adults are found in cultivated fields, grassy meadows, pastures and open oak forests at elevations between 1000 and 3500 m from May into July.

### *Cicindela (Calochroa) fabriciana* Horn

*Calochroa fabricii* Horn, 1894a:171 (preoccupied, Beuthin, 1892:360).

*Type status.* Lectotype, female [here designated]. *Type labels.* "Canara" [typeset]; "Andrewes 94" [handscript]; "Type!, Dr. W. Horn" [typeset]; "Syntypus" [typeset red label]; "DEI, EBERSWALDE" [typeset]; "LECTOTYPE, Calochroa, fabricii W. Horn, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 15 mm; both hind tibiae missing.] Paralectotype, one of each sex at DEI, one paralectotype, male at both BMNH and HMO, and paralectotype, female at MNHB each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. [Additional syntypes at DEI (Döbler, 1973), and BMNH (G. G. Kibby, personal communication, 1983); unexamined.] *Type depository.* Lectotype and two paralectotypes at DEI; one paralectotype each at BMNH, HMO, and MNHB. *Type locality.* "Nord-Canara" (North Kanara, Karnataka, India).

*Cicindela fabricii* Horn: Fowler, 1912:403, fig. 172.

*Cicindela fabriciana* Horn, 1915:303 (replacement name).

*Cicindela octogramma fabriciana* Horn: Horn, 1926:185.

*Calochroa fabricii* Horn: Rivalier, 1961:127.

*Nomenclatural note.*—Horn (1926) attributed the name *fabriciusi* to Beuthin (1892) for a variety of *Cicindela lunulata* Fabricius, but in fact Beuthin had published his name as *fabrici*. Consequently, *fabricii* Horn, 1894, must be considered a junior secondary homonym of *fabrici* Beuthin, 1892 (Articles 53c and 58, ICZN, 1985).

*Diagnosis.*—Distinguished by the dull black elytra; three yellow to orange maculae medially on disc (a few specimens with minute spot at humeral angle).

*Description.*—*General habitus.* Body medium to large (12–18 mm); body robust; head and pronotum slightly shiny black to bronze dorsally, metallic green and blue laterally; elytra dull velvety black with a narrow, shiny green lateral edge; maculae on most specimens as three separate orange oval spots (small humeral dot also present on a few specimens; on a few others spots nearly touch); body metallic purple, green and black ventrally. *Head.* Labrum long with a broad carina; metallic green with a black



anterior edge; five acute teeth coequal in size; six to eight submarginal setae; antennal scape glabrous except for primary seta; right mandible of male with a ventral bulge near base of apical tooth; head glabrous with fine parallel rugae on frons extending onto vertex where they become coarser near eyes and wavy behind eyes. *Prothorax*. Pronotal shape widest behind anterior transverse sulcus, tapering convexly and much narrower across posterior angles with varied numbers of setae laterally, glabrous on disc, surface moderately rugose; proepisterna purplish green, smooth and polished, almost glabrous except for sparse erect setae anteroventrally; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a shallow medial groove. *Elytra*. Surface without contrasting punctures and shiny green laterally with small contrasting green punctures; maculae orange; a small humeral dot present on a few specimens, absent on most others; three large oval spots medially one behind the other (on a few specimens spots enlarged so as to nearly touch one another); microsculptulations small; apical margins uniformly rounded from outer apical angle to suture; apical spine minute. *Abdomen*. Decumbent setae confined to lateral portions of first four sterna, remainder glabrous. *Legs*. Trochanters shiny black, glabrous; femora and tibiae metallic purple, green and copper; tarsomeres purple-green. *Male genitalia*. Aedeagus large with two wide bulges, one at middle, the other subapically, tapering abruptly to a short elongate and rounded tip slightly displaced to the right; subapical flange long, moderately raised at middle in left and right lateral aspects.

*Geographic variation*.—Individuals from the northern parts of the species distribution have smaller and lighter yellow maculae.

*Distribution*.—(Fig. 39). Western Ghats of southern India (Maharashtra, Goa, Karnataka).

*Localities*.—INDIA: Karnataka: 15 km W Mudigere, 28.V.1985, road cut (DLPC); 20 km SW Chikmagalur, 6.VI.1984, forest path (DLPC); 17 km E Dandeli, 12.VI.1984, road cut (DLPC); 20 km W Mudigere, 11.VI.1985, scrub forest (DLPC); 20 km NW Dandeli, 700 m, 28.V.1985, forest path (DLPC, CMNH); Shimoga District, Agumbe Ghat, 615 m, V.1974 (CMNH); Goa: 70 km W Belgaum, 28.V.1985, forest path (DLPC); Maharashtra: 5 km W Ajra, 11.VII.1986, forest path (DLPC); 10 km W Thane, 28.VI.1985, forest path (DLPC).

*Ecology*.—Adults of this species have been taken in partially shaded habitats, such as along road cuts, secondary forest, open primary forest, and coffee plantations between 100 and 900 m.

*Remarks*.—Rivalier (1961) concluded that *Cicindela fabriciana* was distinct from *C. octogramma* because their male genitalic inner sacs possess different sclerites. Additionally, our studies indicate each has a different female coupling sulcus.

### *Cicindela (Calochroa) bicolor* Fabricius

*Cicindela bicolor* Fabricius, 1781:283.

*Type status*. Lectotype, male [here designated]. *Type labels*. "Cic. 2 color, Fabr. Sp. Ins. N2." [format unspecified]; "LECTOTYPE, *Cicindela, bicolor* Fabricius, by R.E. Acciavatti, '84" [typed and hand-printed red label]. [G. G. Kibby examined the syntype, attached the lectotype label, and compared it with a male specimen! loaned to him from CMNH and returned for reference.] [Lectotype size unspecified but its condition was poor with the right elytron missing.] *Type depository*. Lectotype in Banks Collection, BMNH. *Type locality*. "Indes Oriental."

*Cicindela bicolor haemorrhoidalis* Wiedemann, 1823:63.

*Type status*. Lectotype, male [here designated]. *Type labels*. "Mus., Westerman." [typeset]; "♂" [printed small square]; "Bengal, Juli 1809., Haemorrhoidalis Wied." [handscript label with two thin lines forming a border]; "LECTOTYPE, *Cicindela, haemorrhoidalis* Wiedemann, by R.E. Acciavatti, '85" [typed and handprinted red label]. [Lectotype is 15 mm; head glued to prothorax; missing right distal four antennomeres.] *Type depository*. Lectotype at ZMUC. *Type locality*. "Bengalia" (Bengal).

*Cicindela quadrimaculata* Sturm, 1826:55, pl. 1, fig. 1.

*Type status*. Syntype, male [unexamined; because a male is inferred but not so stated in the description, it should be considered syntypic; synonymy follows Horn (1926)]. *Type depository*. Unrecorded. *Type locality*. "Ostindien."

*Cicindela flavopunctata* Audouin, 1832: pl. 18.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* ?MNHN. *Type locality.* "Indes Orientales."

*Cicindela bicolor* Fabricius: Fowler, 1912:400, fig. 171.

*Cicindela haemorrhoidalis xanthospilota* Fowler, 1912:403.

*Type status.* Syntype(s)? [unexamined; concept based on specimens! from India, Kerala, at CMNH]. *Type depository.* Unrecorded; not at BMNH (G. G. Kibby, personal communication, 1984). *Type locality.* "Madras" (India).

*Cicindela bicolor atavus* Horn, 1920:20.

*Type status.* Holotype, female [by monotypy; unexamined; concept based on specimens! from India, Uttar Pradesh, Dehra Dun at DLPC]. *Type depository.* ?NRMS. *Type locality.* "Lachiwala or Lachuwala in Dehra Dun District" (Uttar Pradesh, India).

*Calochroa bicolor* (Fabricius): Rivalier, 1961:127.

*Calochroa bicolor haemorrhoidalis* (Wiedemann): Naviaux, 1984b:73, fig. 58, 59.

*Calochroa bicolor* (Fabricius): Naviaux, 1985:59, fig. 5, 47, 78.

**Diagnosis.** — Distinguished by the large black, indigo or blue-green body; elytral maculae varied from absent to three along midline; reddish orange terminal abdominal sterna.

**Description.** — *General habitus.* Body large (15–17 mm); head and pronotum metallic green or copper; elytra dull, subspecifically varied from black through dark indigo blue to blue-green, and either immaculate or with a small humeral dot and two spots arranged longitudinally on the disc; body ventrally metallic black-green except for reddish orange laterally on fourth sternum and entirely on fifth sternum. *Head.* Labrum long, five-toothed, completely metallic green to purple-green; six or eight submarginal setae; medial carina evident. *Prothorax.* Pronotum with sparse setae at lateral margin on most specimens (glabrous on a few others) disc glabrous; proepisterna glabrous except for sparse setae antero-ventrally, surface wrinkled; prosternum glabrous, coarsely wrinkled. *Pterothorax.* Female mesepisternal coupling sulcus a shallow, broad groove. *Elytra.* Maculae varied (refer to geographic variation) from nonexistent to a small yellow humeral dot and two, large yellow medial spots on each elytron. *Abdomen.* Sterna sparsely setose laterally, glabrous medially. *Legs.* Trochanters shiny black, glabrous; femora metallic copper red to purple green; tibiae and tarsomeres purple. *Male genitalia.* Aedeagus moderately large with two bulky expansions, one at middle, the other on apical third; apex tapering uniformly to a small acute tip slightly displaced to the right; subapical flange long medially situated in left lateral aspect, less evident in right lateral aspect.

**Geographic variation.** — We recognize four subspecies of *Cicindela bicolor*: nominal *Cicindela bicolor* has a metallic green head and pronotum with dull unicolorous, dark indigo blue to blue-green immaculate elytra; *C. bicolor haemorrhoidalis* has a copper head and pronotum, black elytra with a small yellow humeral dot and two large yellow spots one behind the other on each elytron; *C. bicolor xanthospilota*, new combination, has smaller spots but otherwise resembles *C. bicolor haemorrhoidalis*; *C. bicolor atavus* is colored as the nominal subspecies but possesses the markings of *C. bicolor haemorrhoidalis*.

**Distribution.** — (Fig. 36). *Cicindela bicolor bicolor* occurs in Nepal, northeastern India (Bihar, Assam, West Bengal, Meghalaya) as well as Bangladesh and is doubtfully reported from Maharashtra, India, by Heynes-Wood and Dover (1928); *C. bicolor haemorrhoidalis* in Sri Lanka (Hambantota District) and eastcentral India (Madhya Pradesh, Orissa, Bihar) to southern India (Andhra Pradesh, Karnataka, Tamil Nadu), and is also reported from Punjab, Pakistan; *C. bicolor xanthospilota* in southwestern India (Kerala, Tamil Nadu) and Sri Lanka; *C. bicolor atavus* in northwestern India (Uttar Pradesh, Himachal Pradesh, Punjab) and Pakistan.

**Localities.** — *Cicindela bicolor bicolor.* INDIA: West Bengal: Chapra (DLPC). NEPAL: Gorkha District: Arughat-Suteo, 600 to 700 m, 27.VII.1983, waldreste und kulturland (remnant forests and fields)



(SMFM, CMNH). BANGLADESH: Dinajpur District: Dhanjuri, 1963 (JSC). *Cicindela bicolor haemorrhoidalis*. INDIA: Madhya Pradesh: Kanha National Park, 14.VI.1982, forest path (DLPC); Karnataka: 15 km N Bangalore, 12.VI.1983, forest path (DLPC); Bangalore, 4.V.1986, scrub forest (DLPC); 50 km W Dharwar, 520 m, 14.VI.1987, forest path (CMNH); Hoskote, 20.VI.1986, scrub forest (DLPC); 30 km SE Jog Falls, 670 m, 10.VI.1987, scrub forest (DLPC); Shimoga, V.1897 (CMNH); Bihar: 85 km W Ranchi, 23.VI.1986, scrub forest (DLPC); 17 km N Hazaribagh, 21.VI.1986, scrub forest (DLPC); 40 km S Palamau, 22.VI.1986, scrub forest (DLPC); Orissa: Simlipal National Park, 24–25.VI.1986, forest path (DLPC); Andhra Pradesh: 11 km W Narsipatnam, 28.VI.1986, scrub forest (DLPC); 65 km N Waltair, 29.VI.1986, scrub forest (DLPC); 60 km NW Tuni, 1.VII.1986, scrub forest (DLPC); 30 km E Warangal, 5.VII.1986, scrub forest (DLPC). SRI LANKA: Hambantota District: Kataragama, 1.XI.1983 (Naviaux, 1984b). *Cicindela bicolor atavus*. INDIA: Uttar Pradesh: 15 km S Dehra Dun, 10.VII.1982 (DLPC); 15 km N Dehra Dun, 29.VI.1983, forest path (DLPC). *Cicindela bicolor xanthospilota*. INDIA: Kerala: 20 km E Palghat, 18.VI.1983, forest path (DLPC); 20 km N Trichur, 20.VI.1983, forest path (DLPC); Trichur District, Peechi, V.1979 (CMNH); Tamil Nadu: Nilgiri Hills, Devala, 985 m, V.1984 (CMNH).

**Ecology.**—Adults of this species occur over a variety of habitats but are most commonly found on the forest floor (usually mature forest in the north). Acciavatti (1987) reported the species from open, deciduous forests and Naviaux (1985) collected specimens in a shallow gully in a wooded field. Adults occasionally have been taken in tall grass (Pajni et al., 1984) near Chandigarh, Punjab, India. The nominal subspecies also has been found in young rice fields (Fowler, 1912).

### *Cicindela (Calochroa) hamiltoniana* Thomson

*Cicindela hamiltoniana* Thomson, 1857b:323.

**Type status.** Lectotype, female [here designated]. **Type labels.** “Type” [typeset on circular label with red margin]; “Madras, 50/103” [handscript circular label on both sides]; “Hamiltoniana, (White). Thoms.” [handscript]; “LECTOTYPE, *Cicindela, hamiltoniana* J. Thomson, by R.E. Acciavatti, '83” [typed and handprinted red label]. [Lectotype is 15 mm; hind tarsomeres missing.] **Type depository.** Lectotype at BMNH. **Type locality.** “Madras” (India).

*Cicindela flavovittata* Chaudoir, 1865:61.

**Type status.** Holotype [by monotypy; unexamined; synonymy follows Horn (1926)]. **Type depository.** ?MNHN. **Type locality.** “Cote de Coromandel” (Seacoast of Kerala, India).

*Cicindela hamiltoniana* Thomson: Fowler, 1912:167, fig. 169.

*Calochroa hamiltoniana* (Thomson): Rivalier, 1961:127.

**Diagnosis.**—Distinguished by the green or bronze elytra with continuous medial orange and black stripe.

**Description.**—**General habitus.** Body medium to large (14.5–17 mm); body form slender; head, pronotum, and elytra green or bronze, the latter with a longitudinal orange stripe extending from humeral angle nearly to apex and bordered with a black stripe mesad; body metallic purple and green ventrally. **Head.** Labrum tridentate at anterior margin, two broadly acute bulges laterad; medial carina prominent; labral surface black except for two unpigmented ivory areas on each side of middle; frons, vertex and genae glabrous; vertex meets frons at a broadly acute angle; rugae on frons fine, parallel; rugae on vertex coarser, parallel between eyes and midline; vertex surface concave between moderately bulging eyes. **Prothorax.** Pronotum elongate with nearly parallel sides; anterior and posterior transverse sulci moderately impressed and parallel; surface with moderately impressed rugae forming mostly transverse ridges across entire surface, completely glabrous; proepisterna glabrous with shallow, transversely parallel wrinkles; prosternum glabrous with coarse transverse rugae. **Pterothorax.** Female mesepisternal coupling sulcus a broad medial groove. **Elytra.** Shape elongate, parallel sided; sculpturing a composite of granulate-punctate and punctate surfaces; small purple punctures, deepest basally, contrast with a broad, metallic green or bronze marginal band around each elytron; shallow noncontrasting punctures along velvety black medial stripe joining laterad a longitudinal orange stripe; apex with inconspicuous microserulations; apical margins truncated; sutural spine prominent. **Abdomen.** Glabrous except for a patch of decumbent setae on second and third sterna at extreme lateral margin on each sex. **Legs.** Trochanters reddish testaceous, glabrous; femora metallic copper and green; tibiae

and tarsomeres purple, long and slender. *Male genitalia*. Aedeagus short, stocky, widest at middle and maintaining uniform width nearly to apex; apex wide and abruptly truncated; subapical flange absent.

*Distribution*.—(Fig. 40). Western Ghats of southern India (Karnataka, Kerala, Tamil Nadu).

*Localities*.—INDIA: Tamil Nadu: Topslip, Anaimalai Hills, 615 m, V.1977 (CMNH); Mudumalai Refuge, 14.VI.1983, forest path (DLPC); 25 km S Pollachi, 19.VI.1983, forest path (DLPC); Nilgiri Hills, Devala, 985 m, V.1984 (CMNH); Madurai District, Kumili, 770 m, VI.1986 (CMNH); Kerala: Kottayam District, Peermade, 1290 m, V.1975 (CMNH); Periyar, 16.V.1984, forest path (DLPC); 25 km E Chalakudi, 80 m, 20.V.1985, forest path (DLPC); 20 km NW Ootacamund, 19.V.1985, forest path (DLPC); Trivandrum District, Poonmudi Range, 920 m, V.1971 (CMNH); 70 km N Trivandrum, 28.V.1986, forest path (DLPC); 40 km E Quilon, 25.V.1986, forest path (DLPC); Trichur District, Peechi, V.1979 (CMNH); Karnataka: 5 km N Mudigere, 5.VI.1984, forest path (DLPC); 20 km SW Chikmagalur, 6.VI.1984, forest path (DLPC); 20 km W Shencottah, 27.V.1986, forest path (DLPC); Coorg District, Agumbe Ghat, 1230 m, V.1973 (CMNH).

*Ecology*.—This species occurs on the floor of deeply shaded and moist, mature forest above 600 m (above 80 m on the west slope of the Western Ghats). Adults fly from the ground up onto leaves of low branches when disturbed. Fowler (1912) also reported this semiarboreal habit. He mentioned adults along roads and open places in hills at elevations between 770 and 1290 m.

### *Cicindela (Calochroa) discrepans* Walker

*Cicindela discrepans* Walker, 1858:202.

*Type status*. Lectotype, female [here designated]. *Type labels*. "Celon" [handscript]; "59/106" [handscript on both sides of a small circular label]; "Type" [typeset on small circular label with red margin]; "discrepans, Walker Ann, N. Hist. (Type)" [handscript]; "LECTOTYPE, Cicindela, discrepans Walker, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 19 mm; previously pinned through pronotum; right tarsomeres missing.] *Type depository*. Lectotype at BMNH. *Type locality*. "Ceylon" (Sri Lanka).

*Cicindela discrepans* Walker: Fowler, 1912:389, fig. 168.

*Calochroa discrepans* (Walker): Rivalier, 1961:127.

*Calochroa discrepans* (Walker): Naviaux, 1984b:71, fig. 53–55.

*Diagnosis*.—Distinguished by the dull black elytra; elongate medial maculae, the apical one nearly touching lateral margin; nonmetallic labrum; metallic and glabrous trochanters.

*Description*.—*General habitus*. Body large (16–20 mm); head and pronotum copper with slight metallic green reflections; elytra dull black to black-brown and marked with a small humeral spot, an elongate basal dot followed by two oblong medial spots, and a fourth spot near outer apical angle; body shiny dark blackish brown ventrally. *Head*. Labrum long with six submarginal setae and an abrupt medial carina, black with a wide, unpigmented transverse band posteriorly; frons gradually sloping to meet vertex of head at a broad angle; vertex convex anteriorly. *Prothorax*. Pronotum completely glabrous; proepisterna glabrous; prosternum roughened with dense, erect setae adjacent and posterior to procoxa. *Pterothorax*. Female mesepisternal coupling sulcus a broadened groove. *Elytra*. Surface dull, finely granulate with small, shallow blue-green punctures; maculae varied by sex; male humeral spot broad, basal dot elongate, slightly curved and extending for one-fourth of elytral length followed by two oblong spots all arranged behind one another medially, fourth spot situated near lateral margin on apical quarter; female maculae same as male except humeral dot faint or lacking. *Abdomen*. Sterna completely glabrous. *Legs*. Trochanters purplish black, glabrous; femora metallic copper-red and purple; tibiae and tarsomeres purple. *Male genitalia*. Aedeagus large, two bulky sections of nearly equal maximum width, slightly constricted between each; apex tapering abruptly toward a broad tip displaced slightly to the right; subapical flange absent.

*Distribution*.—(Fig. 40). Sri Lanka (Anuradhapura, Badulla, Hambantota, and Kandy districts).

*Localities.*—SRI LANKA: Anuradhapura District: Hunuwilagama, near Wilpattu, 60 m, black light, 28.X–3.XI.1976 (NMNH, CMNH); Badulla District: Badulla, 30.XI.1975 (NMNH); Kandy District: Kandy (DEI). Naviaux (1984*b*) found this species at Kataragama, Hambantota District, Sri Lanka, on 31.X.1983.

*Ecology.*—The adults can be found in drier forests where vegetation is sparse (Naviaux, 1984*b*, 1986). They are active during September until November and fly to black light.

### *Cicindela (Calochroa) lacrymans* Schaum

*Cicindela lacrymans* Schaum, 1863:57.

*Type status.* Lectotype, male [here designated]. *Type labels.* “276” [typeset]; “lacrymans, (N.\*) Schaum, Ceylon Nietn.” [handscript on large, yellow label with black marginal line]; “LECTOTYPE, *Cicindela, lacrymans* Schaum, by R.E. Acciavatti, '84” [typed and handprinted red label]. [Lectotype is 15.5 mm; all appendages intact.] *Type depository.* Lectotype at MNHB. *Type locality.* “Ceylon” (Sri Lanka).

*Cicindela lacrymans* Schaum: Horn, 1904:33.

*Calochroa discrepans lacrymans* Schaum: Fowler, 1912:390.

*Calochroa discrepans lacrymans* Schaum: Naviaux, 1984*b*:71, fig. 56, 57.

*Calochroa lacrymans* Schaum: Naviaux, 1986:61, fig. 12–14.

*Nomenclatural note.*—The following published name has been associated with this species: *stillicidium* Dohrn, 1889:173; however, it was neither described nor figured, and is unavailable.

*Diagnosis.*—Distinguished by the olive-green elytra; elongate spots, the apical one located medially; nonmetallic labrum; metallic glabrous trochanters.

*Description.*—*General habitus.* Body large (15.5–20 mm); head and pronotum metallic copper dorsally, metallic green and blue laterally, and in shallow transverse sulci of pronotum; elytra velvety olive-green, margins copper; several elongate medially situated maculae; body shiny, dark blackish brown ventrally. *Head.* Labrum long, black with a narrow, irregularly unpigmented transverse band posteriorly; medial carina broad; six submarginal setae; frons nearly vertical meeting vertex of head at an acute angle; vertex flattened or depressed anteriorly. *Prothorax.* Pronotum cylindrical and entirely glabrous; fine transverse rugae covers surface; proepisterna glabrous; prosternum smooth, sparse erect setae adjacent to procoxae, but on most specimens absent (some setae on a few specimens) posterior to procoxae. *Pterothorax.* Female mesepisternal coupling sulcus a broadened medial depression. *Elytra.* Surface finely granulate-punctate especially laterally with shallow green punctures; small elytral humeral dot of male reduced or lacking on female; both sexes have a long, narrow yellowish white basal stripe for one-fourth elytral length followed by a shorter narrow spot and by two nearly round spots all arranged one behind the other medially. *Abdomen.* Sterna completely glabrous. *Legs.* Trochanters pitchy black, glabrous; femora metallic copper-red and green, distal end purple; tibiae and tarsomeres purple; all segments long and slender. *Male genitalia.* Aedeagus large, bulky, widest at middle and maintaining maximal width for proximal two thirds; apex abruptly tapering to a broad, truncated tip; subapical flange absent.

*Distribution.*—(Fig. 40). Southwest Sri Lanka (Kandy, Kegalle, Ratnapura and Galle districts).

*Localities.*—SRI LANKA: Kandy District: Kandy, Udawattakele Sanctuary, 645 m, 20–30.VII.1976 and 26.VII.1978 (NMNH); Galle District: Kanneliya Jungle, 13–16.VIII.1972 (NMNH, CMNH); Ratnapura District: Gilimale, 26.III.1981 (DLPC), 3.IV.1981 (NMNH, DLPC); Kegalle District: Kitalgala, 15.IV.1981 (DLPC).

*Ecology.*—Adults have been collected in middle elevation jungle forest from March until August. Naviaux (1986) collected this species along shaded forest paths where it flew to foliage of nearby scrubbery when disturbed.

*Remarks.*—Females of *Cicindela lacrymans* possess a different type of coupling sulcus from that of *C. discrepans* which would likely reproductively isolate the

two species if they occur together. However, adults of each species apparently occur at different seasons and at different elevations to further ensure their isolation. Naviaux (1986) reestablished the specific status of this species based on a suite of additional characters.

### Subgenus *Cicindela* (*Cosmodela*) Rivalier

*Cosmodela* Rivalier, 1961:128.

Type species.—*Cicindela aurulenta* Fabricius, 1801.

**Diagnosis.**—*Cicindela* (*Cosmodela*) species adults are similar to those of subgenus *Cicindela* (*Sophiodela*) by their polychromatic and iridescent external appearance. The male genitalic inner sac of *Cicindela* (*Cosmodela*) adult males, however, has a bulky, rather bumpy aedeagus caused by the long, highly convoluted flagellum which circles to form a rounded lobe on the dorsal aspect where it raises a sustained membrane. Externally, the subgenus adults can be further distinguished from those of other subgenera by: 1) the large body possessing sparse, appressed setae on the dorsal surfaces but covered by moderate amounts of white setae ventrally; 2) a finely rugose head and even more delicate sculpturing to the pronotum which has an alutaceous to almost polished appearance; 3) elytral maculae forming several rather broad, transverse markings medially situated and generally correspond to the humeral and apical lunules, and middle band of *Cicindela* (*sensu stricto*); 4) protruding eyes; 5) nonmetallic labrum often darkly pigmented at margins, a medial carina, six submarginal setae and three to five teeth.

**Remarks.**—Although members of *Cicindela* (*Cosmodela*) possess diagnostic characters, the superficial resemblance of many of its species from different parts of the Oriental biogeographic region makes it quite difficult to distinguish one species from another without a study of the entire Oriental biogeographic fauna. However, such a presentation is beyond the scope of this review.

**Included species.**—The subgenus *Cicindela* (*Cosmodela*) is restricted to the Oriental biogeographic region with the following species occurring on the Indian subcontinent: *C. (C.) aurulenta juxtata*, new name; *C. (C.) virgula* Fleutiaux, 1893; *C. (C.) intermedia* Chaudoir, 1852; *C. (C.) fleutiauxi* Horn, 1915; *C. (C.) duponti* Dejean, 1826.

### Key to adults of *Cicindela* (*Cosmodela*) species

1. Genae with appressed setae over most of its surface ..... 2
  - Genae appearing glabrous, but actually with fine, indistinct hairs ... 4
- 2.(1.) Pronotum with lateral setae ..... 3
  - Pronotum without lateral setae ..... *duponti* Dejean
- 3.(2.) Head and pronotum with metallic copper reflections dorsally; elytral middle band comprised of two spots, separate or narrowly joined to each other ..... *intermedia* Chaudoir
  - Head and pronotum with greenish purple reflections dorsally; elytral middle band comprised of one spot with a short, oblique projection posteriorly ..... *fleutiauxi* Horn
- 4.(1.) Male labrum abruptly raised along a darkened longitudinal ridge or carina at middle contrasting with testaceous lateral areas; female mesepisterna broadly concave, on some specimens shallowly grooved only at middle ..... *virgula* Fleutiaux

- Male labrum lacking an abrupt darkened longitudinal ridge at middle; no more than darkened margins contrasting with testaceous central area; female mesepisterna forming a small, shallow cavity above middle . . . *aurulenta juxtata*, new name (= *aurulenta flavomaculata* Chevrolat)

*Cicindela (Cosmodela) aurulenta juxtata*, new name

*Cicindela aurulenta* Fabricius, 1801:239.

*Type status.* Lectotype, female [here designated]. *Type labels.* [Small green square directly below specimen]; "Type" [typed red label]; "Sumatra, Daldorff, Mus:J.S.T.D., *Cicindela aurulenta* F." [hand-written within two thin black submarginal lines]; "LECTOTYPE, *Cicindela, aurulenta* Fabricius, by R.E. Acciavatti, '86" [typed and printed red label]. [Lectotype is 15 mm.] *Type depository.* Lectotype at ZMUC. *Type locality.* "Sumatra."

*Cicindela flavomaculata* Chevrolat, 1845:95 (preoccupied, Hope, 1831:21).

*Type status.* Syntype(s)? [unexamined; concept based on specimens! from China, Fuchien Province, at ITZA]. *Type depository.* ?MNHNP. *Type locality.* "Macao" (China).

*Cicindela aurulenta flavomaculata* Chevrolat: Schaum, 1863:64.

*Cosmodela aurulenta flavomaculata* (Chevrolat): Rivalier, 1961:128.

*Nomenclatural note.*—Application of the Code (Article 57, ICZN, 1985) to this subspecies name establishes it as a junior homonym of *Cicindela (Calochroa) flavomaculata* Hope (refer to that species discussed earlier). The name *juxtata*, derived from the Latin *juxta* (near to), is here proposed as a replacement name for the preoccupied *Cicindela (Cosmodela) flavomaculata* Chevrolat.

*Diagnosis.*—Distinguished by the large, iridescent copper and greenish black body; glabrous genae (sparse fine hairs on some specimens discussed under geographic variation); male labrum slightly raised testaceous area medially (some specimens with dark margins); female mesepisternal coupling sulcus forming small, shallow cavity above middle.

*Description.*—*General habitus.* Body size large (15–18 mm); head and pronotum metallic copper, edged with green; elytra greenish black with a humeral dot and three large circular to oval spots medially one behind the other; body metallic greenish purple ventrally. *Head.* Labrum longer for female than male; medial carina broad; anterior and posterior edges dark, contrasting with testaceous central area; anterior labral margin with three acute teeth coequal in length and flanked by a rounded bulge, six submarginal setae; vertex finely rugose forming parallel ridges adjacent to eyes, ridges barely distinguishable medially; frons finely rugose; genae appearing glabrous, but actually with fine, indistinct hairs; eyes large and bulging. *Prothorax.* Pronotum subquadrate, posterior angles prominent; surface smooth, slightly alutaceous; transverse sulci shallowly impressed; pronotum glabrous except for sparse, appressed setae at posterior angle (on some specimens also laterally behind middle); sparse semierect and appressed setae only on ventral half of proepisterna; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a small, shallow cavity dorsad. *Elytra.* Surface finely granulate throughout; maculae yellowish white; humeral dot small; three large oval spots along midline of disc, middle spot elongate; apex with small microserrulations; apical margins cojointly rounded on male, separately rounded on female; sutural spine small on both sexes. *Abdomen.* Anterior four female sterna and anterior five male sterna with patches of appressed setae laterally, remaining area hairy. *Legs.* Trochanters nonmetallic black, one subapical seta on each front and middle segment; femora and tibiae metallic copper-green; tarsomeres purple. *Male genitalia.* Aedeagus bulky, body wall bumpy, widest at middle and gradually tapering toward a rounded apex slightly displaced to the right; apical orifice long, extending from below apex nearly to middle, and widened basally with quite regular margins; subapical flange absent.

*Geographic variation.*—We presently recognize two subspecies: nominal subspecies *Cicindela aurulenta aurulenta* is small with small elytral spots; *C. aurulenta juxtata* is larger with correspondingly larger elytral spots.

*Distribution.*—(Fig. 41). *Cicindela aurulenta aurulenta* occurs in Malaysia and

Indonesia (Rivalier, 1961) rather than on the India subcontinent; *C. aurulenta juxtata* enters only the northeastern part of India (Arunachal Pradesh, Assam, Nagaland) from a wide distribution in southern China and Southeast Asia.

*Localities.* —INDIA: Arunachal Pradesh: Kameng Frontier Division, Amatulla, 615 m, 23.V.1961 (CMNH).

*Ecology.* —The habitat is unrecorded but presumably adults occur near forest streams like related species.

### *Cicindela (Cosmodela) virgula* Fleutiaux

*Cicindela virgula* Fleutiaux, 1893b:491.

*Type status.* Syntype(s)? [unexamined; concept based on comparison of its original description with a male specimen! labelled "N. Burma, F. Fisk" at CMNH]. *Type depository.* ?MNHNP. *Type locality.* "Upper Burma, Momeit" (Mong Mit, Shan State, Burma).

*Cicindela aurulenta virgula* Fleutiaux: Fowler, 1912:382.

*Cosmodela aurulenta virgula* (Fleutiaux): Rivalier, 1961:128.

*Cicindela virgula* Fleutiaux: Mandl, 1975:137.

*Cosmodela aurulenta virgula* (Fleutiaux): Naviaux, 1985:63, fig. 10, 50, 80.

*Diagnosis.* —Distinguished by large copper and greenish black body; glabrous genae (sparse fine hairs present); male labrum forming abrupt, darkened medial carina contrasting with testaceous lateral areas; female mesepisternal coupling sulcus broad, shallow groove only at middle.

*Description.* —*General habitus.* Body large (15–18 mm); head and pronotum metallic copper, edged with green; elytra velvety greenish black and shiny copper basally; humeral dot and three large spots medially along midline, the medial one arcuate; body metallic purple and green ventrally. *Head.* Labrum forming abrupt, longitudinal ridge or carina at middle, darkened on male and contrasting with testaceous adjoining areas; female labrum longer than labrum of male; labral margins broadly dark extending onto carina and on a few specimens occupying middle; vertex finely rugose creating numerous parallel ridges which become nearly indistinguishable medially; genae appearing glabrous, but actually with fine inconspicuous hairs. *Prothorax.* Pronotum finely alutaceous; shape subquadrate with prominent posterior angles sparsely setose; transverse sulci moderately impressed; proepisterna smooth, shiny with sparse setae on ventral third; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus broad, shallowly grooved at middle. *Elytra.* Surface finely granulate throughout; maculae yellow; humeral dot small; three large spots one behind the other on the disc, the medial one arcuate; apex with small microsculptulations; apical margins cojointly rounded on male, separately rounded on female; sutural spine small on female, minute on male. *Abdomen.* Sterna laterally with sparse, scattered appressed setae on anterior four segments on female, anterior five on male; fine hairs and primary setae medially. *Legs.* Trochanters nonmetallic black, one subapical seta on each front and middle segment; femora metallic copper-green, distal end purple; tibiae and tarsomeres metallic purple. *Male genitalia.* Aedeagus body wall bulky, bumpy, widest at middle and gradually tapering toward a rounded apex slightly displaced to the right; apical orifice long, extending from below apex nearly to middle, and widened basally with ventral margin quite regular, dorsal margin with a large, rounded basal bulge; subapical flange absent.

*Distribution.* —(Fig. 41). Northern India (Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Nagaland, Meghalaya, Assam, Tripura, Arunachal Pradesh), Nepal, Bhutan, Bangladesh and northern Burma.

*Localities.* —INDIA: Himachal Pradesh: Siwalik Hills, VII.1980 (DLPC); Uttar Pradesh: Rishikesh, VII.1986 (DLPC); West Bengal: 15 km N Siliguri, 3.VI.1985, forest path (DLPC); Assam: 12 km S Gauhati, 12.V.1985 (DLPC); Meghalaya: Jorabat, 8.IX.1984, forest stream edge (DLPC); NEPAL: 15 km S Sauraha, 28.V.1986, gravel river bank (DLPC); 51 km W Kathmandu, 26.V.1986, forest stream edge (DLPC).

*Ecology.* —Adults occur in moist forests along rivers and streams, commonly flying to low vegetation when disturbed. Other open habitats are clay soil in corn

fields, dry loose sand in stream flood plains and damp packed sand along river margins (Acciavatti, 1987).

*Remarks.*—*Cicindela virgula* was elevated to species rank by Mandl (1975) based on the sclerites within the male genitalic inner sac differing from those of *C. aurulenta* Fabricius. Our studies indicating a differently shaped female coupling sulcus for each species further substantiates their distinctiveness.

### *Cicindela (Cosmodela) intermedia* Chaudoir

*Cicindela intermedia* Chaudoir, 1852:6.

*Type status.* Syntype(s)? [unexamined; concept based on comparing its description with specimens! of both sexes labelled "India, Himachal Pradesh, 6 km N Kalka, 17.VII.1983, rocky creek bed" at DLPC]. *Type depository.* ?MNHNP. *Type locality.* "Indes Oriental."

*Cosmodela intermedia* (Chaudoir): Rivalier, 1961:128.

*Cicindela ferriei kasyi* Mandl, 1967:454, new synonymy.

*Type status.* Holotype, female [unexamined; concept based on two females! from "India, Kumaon, Himalaya District, Maini Tal, Bhim Tal, 1500 m, 18.VI.1971, leg. de Freina" at RLHC determined by Mandl; neither specimen differs significantly from *Cicindela intermedia* Chaudoir]. *Type depository.* ?NMV. *Type locality.* "Afghanistan, 25 km N Barikot, Nuristan, 1200 m."

*Cicindela intermedia kasyi* Mandl: Mandl, 1981a: 14, new synonymy.

*Diagnosis.*—Distinguished by the medium sized body with copper, blue and green iridescence; genae setose; elytral maculae comprised of a divided humeral lunule and two separated or narrowly joined segments of a middle band; apical spot large.

*Description.*—*General habitus.* Body medium (14–15 mm); head and pronotum copper dorsally, blue and green laterally and in the transverse sulci of the pronotum; elytra olive-green to purple-green with a divided humeral lunule and middle band comprised of two separate or narrowly joined spots, and a large apical spot; body metallic green ventrally. *Head.* Labrum long, anterior and posterior margins broadly dark, center broadly testaceous; medial carina evident; four to six submarginal setae; labrum tridentate; genae setose. *Prothorax.* Pronotum glabrous on disc, laterally with large, sparse setigerous punctures; proepisterna with only ventral half setose; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus shallow, elongate or circular pit medially; metepisterna setose. *Elytra.* Surface granulate-punctate; shallow purple punctures contrast with olive-green color on most specimens; disc entirely dark purple-green on a few specimens; maculae as a divided humeral lunule and middle band, and a large apical spot, only the dot at the humeral angle touches the lateral margin, all others are situated on the disc; microserrulations of apex moderately large; apical margins rounded on male, slightly truncated on female; sutural spine small. *Abdomen.* Anterior five sterna on female, anterior six on male, moderately setose; appressed setae near lateral margin but most of surface possessing sparse erect hairs with long primary setae near posterior edge of sterna three to five. *Legs.* Trochanters nonmetallic shiny pitch black, one subapical seta on each front and middle segment; femora metallic green except for purple-green apex; tibiae metallic green; tarsomeres purple. *Male genitalia.* Aedeagus bulky, body wall bumpy, widest at middle and gradually tapering distally to a small, rounded apex not displaced to the right; apical orifice long, extending from below apex nearly to middle, and widened basally with irregular margins; subapical flange absent.

*Geographic variation.*—Populations throughout most its distribution possess olive-green elytra with contrasting purple punctures on the disc. However, populations from southcentral Nepal have a dark purple-green elytral disc with only slight or no contrasting punctures and larger, bolder maculae with a complete middle band; these populations represent a new subspecies described below.

*Distribution.*—(Fig. 41). Nominal *Cicindela intermedia* occurs from Afghanistan through Pakistan (Northwest Frontier, Punjab) and northern India (Jammu and Kashmir, Punjab, Himachal Pradesh, Uttar Pradesh), into western and north-central Nepal; a new subspecies described below occurs in southcentral Nepal.



*Localities.*—*Cicindela intermedia intermedia*. NEPAL: Dhading District: Buri Gandaki, Pangshing below Nyak, 1600 to 1800 m, mixed woodland, 1.VIII.1983 (SMF, CMNH); 15 km S Sauraha, 28.V.1986, gravel river bank (DLPC). INDIA: Himachal Pradesh: 20 km N Kalka, 26.VI.1983, rocky creek bed (DLPC); 6 km N Kalka, 17.VII.1982, rocky creek bed (DLPC, CMNH); Uttar Pradesh: 15 km N Dehra Dun, 29.VI.1983, forest path (DLPC); Rishikesh, Ganga River, VIII.1986 (KWC, CMNH); Punjab: 24.VII.1971 (CMNH). PAKISTAN: Hazara: Bharaziarat, 18.VIII.1963, on wing (NMNH).

*Ecology.*—Adults occur on rocky shores and large exposed boulders of mountain streams. During the monsoon season, local flooding may drive them into forests near these streams. This species is commonly found with *Cicindela (Ifasina) subtilesignata* Mandl and *C. (Eriodera) albopunctata* Chaudoir. Reported from gravelly stream banks above 900 m (Acciavatti, 1987).

*Remarks.*—*Cicindela (Cosmodela) intermedia* Chaudoir, and the Palearctic *Cicindela (sensu stricto) ferriei* Fleutiaux, 1894:281, superficially resemble one another for dorsal color and elytral maculae; however, they differ by their male genitalic internal structure. These species differ by external characters because only the former has setose genae, pronotum and proepisterna; furthermore, their ranges are widely separated.

### *Cicindela (Cosmodela) intermedia chitwanae*, new subspecies

*Description.*—*General habitus.* Similar to the nominal subspecies with the same surface body sculpturing, setal patterns of the head, prothorax, and pterothorax, female coupling sulcus and male genitalia; however, differing by the slightly larger body size with dark purple-green color of the elytral disc, and larger, bolder elytral maculae with the middle band narrowly joined rather than unequally divided into two spots as the nominal subspecies.

*Type specimens.*—Holotype, female, labelled "NEPAL: Chitwan N.P., 15 km S Sauraha, 28.V.1986, D.L. Pearson" [typeset]; "forest stream edge" [typeset]; "HOLOTYPE, *Cicindela, intermedia, chitwanae*, Acciavatti & Pearson" [typed and printed red label]. Male allotype, one female paratype labelled same as holotype.

*Type depository.*—Holotype at IARI; allotype at NMNH; paratype to DLPC.

*Type locality.*—Chitwan National Park, 15 km S Sauraha, Nepal.

*Distribution.*—(Fig. 41). Southcentral Nepal.

*Ecology.*—Adults of this subspecies occur with *Cicindela virgula*, but are much less common.

*Etymology.*—This feminine singular name is derived from the type locality of Chitwan, using the genitive Latin ending.

*Remarks.*—The dorsal color and elytral maculae of *Cicindela (Cosmodela) intermedia chitwanae* superficially resemble *C. (Cosmodela) virgula* but its body sculpturing and form clearly indicate it belongs with *C. (Cosmodela) intermedia* from which it differs by its darker body, bolder elytral maculae and narrowly complete middle band.

### *Cicindela (Cosmodela) fleutiauxi* Horn

*Cicindela oberthuri* Fleutiaux, 1893a:316 (preoccupied, Péringuey, 1888:221).

*Type status.* Lectotype, male [here designated]. *Type labels.* "Coll. R.I.SC.N.B., Inde, Nord Bengale" [typeset and handprinted yellow label]; "Environs de Kurseong, R.P. Bretauudeau" [typeset label glued to the previous]; "E. Fleutiaux det 1893, *Cicindela oberthuri* N sp." [handprinted]; "Para-, type" [typeset orange label]; "W. Horn det 1915, *Cicindela fleutiauxi* nom. n." [handprinted]; "LECTOTYPE, *Cicindela, oberthuri* Fleutiaux, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 12.5 mm.] Paralectotypes, two females each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository.* Lectotype and two paralectotypes at IRSNB. *Type locality.* "Sikkim, India."



*Cicindela oberthuri* Fleutiaux: Fowler, 1912:380, fig. 166.

*Cicindela fleutiauxi* Horn, 1915:299 (replacement name).

*Cicindela berthuri* (sic) Fleutiaux: Heynes-Wood and Dover, 1928:85.

*Cosmodela fleutiauxi* (Horn): Rivalier, 1961:128.

*Cicindela loffleri* (sic) Mandl, 1970:213, new synonymy.

*Type status.* Holotype, female [by original description]. *Type labels.* "NEPAL, Charna-, watikola, 14-6-64, Dr. H. Löffler, leg." [handprinted]; "22" [typeset]; [small square unmarked label, red on only one side]; "Type-*Cicindela*, intermedia ssp, löffleri m. 1966, lng. K. Mandl" [first and last lines typeset, remainder handprinted, red on only one side]. *Type depository.* Holotype at ZSBS. *Type locality.* "Nepal, Charnawatikola, ca. 1500 m."

*Cicindela fleutiauxi loffleri* (sic) Mandl: Mandl, 1975:137, new synonymy.

*Cosmodela fleutiauxi* (Horn): Naviaux, 1985:63, fig. 11, 49, 81.

*Nomenclatural note.*—The subspecific name *Cicindela fleutiauxi loffleri* is an incorrect original spelling based on Löffler and must be corrected to *Cicindela fleutiauxi loeffleri* according to the Code (Article 32) (ICZN, 1985).

*Diagnosis.*—Distinguished by the large, dark greenish purple or bluish black body; genae setose; four white elytral spots, middle one on disc with an oblique, posterior projection.

*Description.*—*General habitus.* Body large (13–15 mm); head and pronotum greenish purple reflections; elytra dull, dark blue or black medially with green and purple iridescence laterally and along suture; maculae white, as a humeral spot and three large spots medially one behind the other, medial one with a posterior projection; body metallic green and purple ventrally. *Head.* Labrum long, medially with three large acute teeth coequal in length flanked on either side by a broad, rounded bulge, anterior and posterior margins dark, medially ivory with a broad medial carina and six submarginal setae; vertex with moderately raised rugae forming parallel ridges extending onto frons; rugae irregular medially, shallow and transverse behind eyes; eyes large and bulging; genae with appressed setae covering most of surface. *Prothorax.* Pronotum subquadrate, widest behind anterior transverse sulcus, surface smooth, alutaceous, anterior and posterior transverse sulci moderately impressed; pronotum laterally with sparse, appressed setae; proepisterna with sparse appressed setae over most of surface except on dorsal quarter; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a medial pit. *Elytra.* Maculae white; small spot at the humeral angle and three larger ones arranged along midline of disc; middle spot on disc with a short oblique posterior projection; apex with small microsculptulations; apical margins evenly rounded on male, slightly truncated on female; sutural spine minute. *Abdomen.* Sterna covered by appressed setae laterally and sparse, fine hairs and a few primary setae medially. *Legs.* Trochanters dark nonmetallic, one subapical seta on each front and middle segment; femora metallic green, distal end purple; tibiae metallic green; tarsomeres purple. *Male genitalia.* Aedeagus bulky, body wall bumpy, widest at middle and gradually tapering distally to a broad apex slightly displaced to the right; apical orifice long, extending from below apex nearly to middle and widened basally with dorsal margin creating a lobe; subapical flange absent.

*Distribution.*—(Fig. 41). Northern India (West Bengal, Assam, Sikkim, Arunachal Pradesh), Bhutan, Nepal and Bangladesh.

*Localities.*—INDIA: Arunachal Pradesh: Kameng Frontier Division, Bhairabkundi, 310 m, V.1961 (CMNH); Kameng (NEFA) (Frontier Division), Bairab, 900 m, V.1967 (DLPC); Bomdi (Bomdila), 2710 m, I.V.1961 (JSC); West Bengal: Darjeeling District, Namsoo, 645 m, VI.1919 (BMNH). NEPAL: Sildhunga, 20 mi W Jiri, 925 to 1230 m, IX.1970 (CMNH); Dhawalagiri, I.VII.1986, 900 m (DLPC); Janakpur, Tamba Kosh Khola, SE Charicot, 900 to 1200 m, 16–25.VI.1987 (JPC, CMNH); Dhading District: Ankhu Khola Tal, Ankhu Sang, 530 to 750 m, 26.VII.1983 (SMFM, CMNH).

*Ecology.*—Adults have behavior and habits similar to *Cicindela virgula* and replace that species above 500 m; however, they are not as common as *C. virgula* (Pearson and Ghorpade, 1987).

*Remarks.*—*Cicindela fleutiauxi loeffleri* Mandl does not differ from *C. fleutiauxi* Horn because populations from several disjunct localities have some individuals with the green femora and tibiae considered characteristic of *Cicindela fleutiauxi loeffleri*; other individuals have the copper femora and tibiae of the nominal taxon.

*Cicindela (Cosmodela) duponti* Dejean

*Cicindela duponti* Dejean, 1826:419.

*Type status.* Syntype(s)? [unexamined; concept presented under geographical variation below]. *Type depository.* ?MNHNP. *Type locality.* "Cochin China."

*Cicindela barmanica* Gestro, 1893:360.

*Type status.* Lectotype, male [here designated]. *Type labels.* "Carin Cheba, 900–1100. m., L. Fea V XII-88" [handprinted label with thin black border]; "duponti var., barmanica Gestro" [handprinted]; "PARATYPUS" [typeset pink label]; "Museo Civico di Genova" [typeset]; "LECTOTYPE, *Cicindela, barmanica*, Gestro by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 15.5 mm.] Paralectotype, female [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository.* Lectotype at MCSNG; paralectotype at IRSNB. *Type locality.* "Monti Carin, Cheba District" (Kayah State, Burma).

*Cicindela indica* Fleutiaux, 1893b:490 (*nec* Fleutiaux, 1893b:484).

*Cicindela duponti* Dejean: Fowler, 1912:382.

*Cicindela barmanice* (*sic*) Gestro: Heynes-Wood and Dover, 1928:83.

*Cosmodela duponti* (Dejean): Rivalier, 1961:128.

**Diagnosis.**—Distinguished by the large, iridescent bluish and purplish green body; elytra dull blackish purple with shiny blue or copper margins and four white spots; setose genae; glabrous lateral pronotal margins.

**Description.**—*General habitus.* Body large (15–18 mm); head and pronotum smooth, shiny blue-green (copper on some specimens); elytra shiny blue-green on most specimens (copper on some specimens) around entire perimeter and across middle on basal third; elytra medially dull blackish purple, appearing velvety; white maculae forming a humeral dot and three small spots (middle one long, transverse) equally spaced along elytral length; body metallic purple-green ventrally. *Head.* Labrum long; three teeth, coequal in length on most females, middle tooth small or lacking on most males; genae sparsely setose on ventral half; distal segment of labial palpus metallic blue and penultimate segment darkened slightly metallic on female, nonmetallic testaceous on male. *Prothorax.* Pronotum entirely glabrous, sculpture smooth, almost polished; proepisterna smooth, polished, and dorsally glabrous with sparse erect setae on anterior portion and sparse appressed setae ventrally; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a small, shallow elongate depression medially; mesepisterna on both sexes with sparse, appressed setae ventrally; mesepimeron covered by sparse, erect setae. *Elytra.* Shiny blue-green (copper on some specimens) suture, lateral margin and transverse basal band, the latter divides dull blackish purple disc into two unequal areas; maculae whitish; humeral dot small; small dot near lateral margin within transverse basal band (minute on some specimens, absent on others); large, long and transverse spot lying across largest dull discal area, and a smaller spot on apical third; microsculptulations small; sutural spine small; apical margins separately rounded on female, conjointly rounded on male. *Abdomen.* First three sterna with decumbent lateral setae, remaining sterna covered by abundant fine hairs except at middle. *Legs.* Trochanters dark metallic black, slight purple reflections, one subapical seta on each front and middle segment; femora green, blue and copper except for purple distal end; tibiae and tarsomeres purple. *Male genitalia.* Aedeagus bulky, body wall bumpy, widest at middle and gradually tapering distally to a broadly rounded apex slightly displaced to the right; apical orifice long, extending from below apex nearly to middle, widened basally with both margins irregular and forming asymmetrical basal lobes, one in left lateral aspect well developed on all specimens, one in right lateral aspect evident on some specimens, less evident on others; subapical flange absent.

**Geographic variation.**—The populations generally assignable to this species exhibit considerable variation in characters, such as setae on the genae, pronotal color and shape, elytral color and sculpturing, and male genitalic surface features. Specimens having copper pronotum and elytra occur sporadically in southern and northeastern India as the aberration *Cicindela barmanica* Gestro. Specimens from Vietnam lack setose genae, and appear to represent a separate species. Since the type of *Cicindela duponti* Dejean originated from Southeast Asia, the name *C. duponti* may apply to these populations, thereby leaving specimens from the

Indian subcontinent assignable to *C. barmanica* Gestro. Furthermore, specimens from northeast India (Assam, Meghalaya) differ from those in southern India (Karnataka) by the basal lobes at the apical orifice of the male aedeagus and other characters of the head and pronotum, possibly warranting recognition as a new species. However, a conclusion about the true nature of the name *Cicindela duponti* Dejean, with respect to these different populations, cannot be resolved until its syntype has been examined.

**Distribution.**—(Fig. 41). India (Karnataka, Goa, Kerala, Madhya Pradesh, Bihar, Assam, Meghalaya, Arunachal Pradesh, Nagaland, Manipur), and Bangladesh (Dacca) eastward into Burma and Southeast Asia.

**Localities.**—INDIA: Kerala: 20 km W Shencottah, 27.V.1986, forest path (DLPC); 70 km N Trivandrum 28.V.1986, forest path (DLPC); 35 km N Palghat, 650 m, 19.VIII.1986, forest stream (DLPC); Quilon District, Tenmalai, 170 m, V.1985 (CMNH); Tamil Nadu: Nilgiri District, Devala, 985 m, V.1984 (CMNH); Karnataka: Shimoga District, Agumbe Ghat, 615 m, V.1981 (CMNH); 20 km SW Chikmagalur, 6.VI.1984, forest path (DLPC); 7 km E Sulya, 4.VI.1984, moist creek bed (DLPC); 20 km N Mudigere, 18.V.1986, forest stream (DLPC); Mudigere, 9.VI.1985, forest stream edge (DLPC); Mudigere, 2.VIII.1984 (DLPC); Nagarhole National Park, 24.VI.1985, forest stream (DLPC); 60 km W Belgaum, 28.V.1985, moist creek bed (DLPC); Jog Falls, 550 m, 10.VI.1987, forest stream edge (DLPC); Goa: 54 km E Pangji, 13.VI.1984, moist creek bed (DLPC); 56 km E Pangji, 17.VII.1986, forest stream (DLPC); Bihar: 100 km W Ranchi, 23.VI.1986, forest stream (DLPC); Assam: 12 km S Gauhati, 12.V.1985 (DLPC); Jorabata, 8.IX.1983 (DLPC); Meghalaya: 12 km S Nongpoh, 5.V.1985 (DLPC). BURMA: Carin Cheba, 900 to 1100 m, V to XII.1888 (MCSNG, IRSNB).

**Ecology.**—Adults of this species are limited to the vicinity of small forest streams or stream beds.

### Subgenus *Cicindela* (*Plutacia*) Rivalier

*Plutacia* Rivalier, 1961:129.

Type species.—*Cicindela dives* Gory, 1833.

**Diagnosis.**—*Cicindela* (*Plutacia*) species adults by their external appearance superficially resemble those of *Cicindela* (*Ancylia*) and *Cicindela* (*Pancallia*), but can be distinguished from adults of these and related subgenera by: 1) a large male genital capsule with a bulky internal sac containing a long, convoluted flagellum ensheathed by a membrane and forming rounded lobes lying freely within the capsule; two lobes on the dorsal aspect and a large one covering much of the ventral aspect; 2) medium to large, robust body; 3) head with small eyes, not protruding; 4) broad labrum with six submarginal setae and six to ten small to minute teeth of varied size, irregularly spaced along the anterior margin; 5) elytral maculae broad, oblique to transverse, almost touching lateral margin.

**Included species.**—*Cicindela* (*Plutacia*) is restricted to India and includes: *C. (P.) dives* Gory, 1833; *C. (P.) notopleuralis* Acciavatti and Cassola, 1989.

### Key to adults of *Cicindela* (*Plutacia*) species

1. Pronotal lateral edge evenly rounded; elytra maculae comprised of three obliquely transverse bands; one subapical seta on each front and middle trochanter ..... *dives* Gory
- Pronotal lateral edge narrowly raised, reflexed and striated along a ridge; elytral maculae comprised of a small humeral spot and a large, nearly trapezoidal spot at middle; anterior and middle trochanters glabrous ...  
..... *notopleuralis* Acciavatti and Cassola

*Cicindela (Plutacia) dives* Gory

*Cicindela dives* Gory, 1833: pl. 97.

*Type status.* Syntype(s)? [unexamined; concept based on a male! and female! labelled "Kanara, S. India, Canara, Andrewes, Bequest, B.M. 1922-221, EX. BMNH," at RDWC]. *Type depository.* ?MNHNP. *Type locality.* "Indes Orientales, Deccan" (India).

*Cicindela dives* Gory: Fowler, 1912:413, fig. 177.

*Plutacia dives* (Gory): Rivalier, 1961:129.

*Nomenclatural note.*—The following published name has been associated with this species: *ambitiosa* Dejean, 1837:3; however, because there was neither a description nor figure published, this name is unavailable.

*Diagnosis.*—Distinguished by the large, copper-red and purple body; elytra velvety green with three elongate yellow spots; edge of the lateral pronotopleural suture evenly rounded; subapical seta on each anterior and middle trochanter.

*Description.*—*General habitus.* Body large (15–17 mm); head and pronotum shiny green and copper-red; elytra velvety green with a metallic copper-red margin; three wide yellow maculae edged with black, obliquely transverse as humeral and apical lunules and a middle band; body metallic purple ventrally. *Head.* Labrum long, broad, surface smooth, ivory testaceous, nonmetallic; anterior edge darkened; six to ten small to minute teeth at anterior margin varied in size with middle and lateral ones on each side the largest; six submarginal setae; antennal scape glabrous except for primary setae; frons and vertex moderately rugose forming parallel ridges; rugae near eyes converging anteriorly but not extending onto frons, those at middle oblique and transverse, those behind eyes wavy and irregular; genae covered by long, ventrally directed setae. *Prothorax.* Pronotal shape subquadrate, widest behind anterior transverse sulcus and narrowest at small bulging posterior angles; surface coarsely rugose with irregular raised ridges; lateral margin with sparse erect setae; anterior transverse sulcus deeply impressed, posterior sulcus less impressed; proepisterna with a roughened surface and covered by long, erect to semierect setae; prosternum with sparse erect setae. *Pterothorax.* Female mesepisternal coupling sulcus narrowly grooved dorsally, broadened ventrally; mesepisternal surface anteriorly smooth and glabrous, posteriorly rough and sparsely setose; scutellum rugose and metallic purplish copper. *Elytra.* Shape broad, widest at middle, humeral angle broadly acute, apical angle evenly rounded; surface appearing velvety, minutely granulate-punctate with punctures small on basal two-thirds, punctures shallow to nearly impunctate on apical third; lateral margin and near scutellum metallic copper-red; lateral edge inflated on female; maculae yellow broadly edged with black; humeral lunule wide, oblique; middle band nearly transverse; apical lunule wide nearly touching suture; small microserrulations and a broad, short sutural spine at apex. *Abdomen.* All sterna, except sixth on female, almost completely covered by scattered, semierect and erect setae which are more numerous laterally and lacking at center on the female. *Legs.* Trochanters dark shiny black, one subapical seta on each front and middle segment; femora and tibiae metallic purple-red; tarsomeres black-green. *Male genitalia.* Aedeagus large, widest at middle and of nearly uniform width for most of distal half before it abruptly tapers to a rounded apex slightly displaced to the right; apex with a highly raised, long flange in left and right lateral aspects extending from apex basally and parallel to apical orifice for its entire length.

*Distribution.*—(Fig. 42). India (Sikkim, West Bengal, Madhya Pradesh, Maharashtra, Karnataka).

*Localities.*—INDIA: Karnataka: Kanara (RDWC); Maharashtra: Bombay (IRSNB).

*Ecology.*—The habitat of this species is unrecorded; its scarcity in collections suggests a restricted habitat preference.

*Cicindela (Plutacia) notopleuralis* Acciavatti and Cassola

*Cicindela (Plutacia) notopleuralis* Acciavatti and Cassola, 1989:71.

*Type status.* Holotype, male!. *Type depository.* Holotype at MNHNP. *Type locality.* "Balasore, Balasore District, Orissa, India."

*Diagnosis.*—Distinguished by the large green and black body; pronotopleural

suture narrowly raised, forming a reflexed ridge with numerous short parallel grooves; front and middle trochanters glabrous.

*Description.*—*General habitus.* Body large (20.5 mm); dorsum dull black; head laterally slightly green and purple; pronotum laterally shiny green; elytra dull black, epipleura pale nonmetallic; elytral maculae yellow-orange, humeral spot small, middle spot large, nearly trapezoidal; body purple-black ventrally, tinged metallic green; abdomen reddish purple, nonmetallic. *Head.* Labrum short, broad, surface smooth, except for a small shallow depression near base on either side of middle, ivory testaceous, nonmetallic; anterior edge wide, darkened; eight small to minute teeth along anterior margin, middle one largest, lateral ones grouped by threes on each side, six submarginal setae; antennal scape with six to eight basal setae besides the single, subapical primary seta; fourth male antennomere with penicillum of 16 to 20 stiff pale reddish bristles; antennomeres nonmetallic, basal four dark reddish, distal seven pale yellow; frons with numerous parallel, finely raised rugae; vertex moderately rugose, rugae forming parallel ridges except for a wide smooth band at inner margin of eye; rugae near eyes converging anteriorly and not extending onto frons, rugae medially becoming oblique and converging along midline, rugae behind eyes finer, irregular; clypeus, genae, frons and vertex glabrous; eyes large and flattened, bulging only slightly outward. *Prothorax.* Pronotal shape subquadrate; small, nonbulging posterior angles; surface finely and irregularly rugose on disc, more coarsely rugose laterally; narrow, raised reflexed ridge with numerous short parallel grooves along the entire lateral edge; surface nearly covered by sparse, appressed setae more numerous at anterior and lateral margins; proepisternal surface wrinkled dorsally from numerous finely impressed parallel ridges which become shallower and irregular medially and ventrally; surface nearly glabrous except for scattered long, appressed to semierect white setae near anteroxocal margin; prosternum glabrous. *Pterothorax.* Male mesepisterna broad, smooth and glabrous except for sparse setae near ventral and posterior margins; mesepimera entirely, and metasternum laterally, covered by dense appressed white setae; metepisterna and metepimera glabrous, surface slightly wrinkled. *Elytra.* Shape broadly elongate, widest at apical third; slightly obtuse humeral angle, broadly rounded outer apical angle; surface dull, velvety black, minutely granulate-punctate, small, noncontrasting black punctures uniformly dense throughout and only slightly deeper on basal third; black impunctate suture; epipleura pale, nonmetallic; maculae yellow-orange; humeral spot small; middle spot large, nearly trapezoidal, narrowest near lateral margin, widest near middle, narrowed and slightly arcuate near suture; minutely microserrulate apex; broad, short sutural spine. *Abdomen.* Sterna completely glabrous except for appressed and semierect white setae laterally on basal three confined to scattered patches. *Legs.* Trochanters dark shiny reddish brown, glabrous; femora thickened basally, especially anterior pair, surface dark, shiny reddish brown, slight metallic purple tinge, covered by numerous, large scattered spines; tibiae shiny purple; tarsomeres shiny purple. *Male genitalia.* Aedeagus large, narrowest on basal third and gradually enlarged to a bulbous apical half, then abruptly tapering to a broadly truncated apex with a short acute tip, slightly displaced to the right; a broad shallowly raised and long flange in left and right lateral aspects extending from apex basally, then perpendicular to, and then parallel to apical orifice such that a broad shallow concavity is developed medially in both lateral aspects on distal quarter of the aedeagus.

*Distribution.*—(Fig. 42). India (Orissa).

*Localities.*—INDIA: Orissa: Balasore District, Balasore (MNHNP).

*Ecology.*—The adult habitat is unrecorded but possibly forests.

*Remarks.*—*Cicindela (Plutacia) notopleuralis* superficially resembles *Cicindela (Pancallia) princeps*, but can be distinguished from that species by the narrowly raised, reflexed and striated ridge along the lateral pronotal margin.

### Subgenus *Cicindela (Chaetodera)* Jeannel

*Cicindela (Chaetodera)* Jeannel, 1946:151.

Type species.—*Cicindela regalis* Dejean, 1831.

*Chaetodera* Jeannel: Rivalier, 1958:330.

*Rivaliera* Pajni and Bedi, 1974:939, new synonymy.

Type species.—*Cicindela albina* Wiedemann, 1819.

*Pseudochaetodera* Pajni and Bedi, 1974:940, new synonymy.

Type species.—*Cicindela vigintiguttata* Herbst, 1806.

*Nomenclatural note.*—Pajni and Bedi (1974) created new, separate genera for the two species occurring in the Oriental biogeographic region; however, we believe the characters exhibited by these two species unite them to, rather than separate them from, related species of the Ethiopian biogeographic region.

*Diagnosis.*—*Cicindela* (*Chaetodera*) species adults are related to those subgenera for which the male aedeagus contains a well developed internal sac with a long, highly convoluted flagellum raising a sustained membrane which forms an encasing fold on the right dorsal aspect. Adults of this subgenus can be distinguished from those of related subgenera by: 1) medium to large body size; 2) elytral maculae forming a complex pattern of markings which generally correspond to the humeral and apical lunules, the middle band with an extension along the lateral margin, a basal spot, and a sutural band, each of which is either fused into one continuous pattern or fragmented into numerous isolated spots; 3) abundant amounts of decumbent white setae dorsally and ventrally; 4) the fourth proximal male antennomeres have additional setae; penicillum of stiff bristles on adults of one species.

*Included species.*—Two species of *Cicindela* (*Chaetodera*) occur on the Indian subcontinent: *C. (C.) vigintiguttata* Herbst, 1806; *C. (C.) albina* Wiedemann, 1819.

#### Key to adults of *Cicindela* (*Chaetodera*) species

1. Genae and clypeus densely covered by white decumbent setae; elytral maculae forming a continuous pattern of fused lunules nearly obscuring the surface ..... *albina* Wiedemann
- Genae and clypeus glabrous; elytral maculae forming a pattern of ten oval or elongated spots distributed over the entire dark surface ..... *vigintiguttata* Herbst

#### *Cicindela* (*Chaetodera*) *albina* Wiedemann

*Cicindela albina* Wiedemann, 1819:169.

*Type status.* Lectotype, female [here designated]. *Type labels.* “Mus. Westerm.” [typeset]; “♀” [printed small square], “Type” [red typeset]; “Bengali, Juni 1809, Albina Wied.” [handscript]; “Zool. Museum, DK Copenhagen” [typeset]; “LECTOTYPE, *Cicindela albina* Wiedemann, by R.E. Acciavatti, ‘83” [typed and handprinted red label]. [Lectotype is 14.5 mm.] Paralectotypes, three females [here designated] each labelled “PARALECTOTYPE” [typed and handprinted red label]. *Type depository.* Lectotype and three paralectotypes at ZMUC. *Type locality.* “Bengal.”

*Cicindela albida* Dejean, 1825:125.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* ?MNHN. *Type locality.* “Indes Orientales.”

*Cicindela albina* Wiedemann: Fowler, 1912:427, fig. 191.

*Chaetodera albina* (Wiedemann): Rivalier, 1961:128.

*Rivaliera albina* (Wiedemann): Pajni and Bedi, 1974:939.

*Rivaliera albina* (Wiedemann): Naviaux, 1985:66, fig. 16, 51, 82.

*Diagnosis.*—Distinguished by the medium to large body covered by dense, decumbent white setae; genae and clypeus obscured by white setae.

*Description.*—*General habitus.* Body medium to large (13–16 mm); dorsally dense, decumbent white setae on most of the head and pronotum; elytral surface almost completely obscured by maculae forming four bands which encompass all margins and much of disc; body ventrally nonmetallic brown testaceous, pleura and sterna almost entirely obscured by dense decumbent white setae. *Head.* Clypeus, frons, vertex and genae obscured by dense decumbent white setae; antennal scape, third and fourth proximal antennomeres with thick, decumbent setae besides primary seta; mandible base sparsely

setose on male, glabrous on female; maxillary and labial palpi nonmetallic on both sexes, terminal segment dark on apical half. *Prothorax*. Pronotum laterally covered by dense, decumbent white setae, medially setae form a longitudinal band on each side of center, surface nearly glabrous and alutaceous on either side of this band. *Pterothorax*. Mesepisterna nearly covered by dense, decumbent white setae except for anterior portion; female mesepisternal coupling sulcus a broad, moderately deep depression medially along posterior margin. *Elytra*. Maculae extensive, forming a continuous white sutural band apically joining a complete marginal band from which two lunules project obliquely onto disc, and an elongate white basal dot. *Abdomen*. Sterna nearly covered by dense, decumbent white setae obscuring surface. *Legs*. Trochanters reddish brown, glabrous; femora, tibiae and tarsomeres covered by white, decumbent setae; tarsal claws long, nearly equal to distal tarsomere. *Male genitalia*. Aedeagus small, slender, narrow at middle and abruptly widening to a uniform and maximum width on apical third before tapering abruptly to a blunt rounded apex; subapical flange in left lateral aspect short, medially situated below apex; flange in right lateral aspect inconspicuous.

*Distribution*. — (Fig. 40). Pakistan (Punjab), northern India (Punjab, Bihar, West Bengal, Orissa, Haryana, Uttar Pradesh) and Bangladesh (Rajshahi).

*Localities*. — INDIA: Union Territories: Chandigarh, 29.VII.1982, river sand bar (DLPC); Haryana: 10 km S Chandigarh, 15.VII.1982, river sand bar (DLPC, CMNH); Chandigarh, 1.VII.1983, sandy river beach (DLPC, CMNH); Uttar Pradesh: Saharanpur, 9.VII.1982, river sand bar (DLPC, CMNH); Punjab: 17 km N Rajpura, 27.VII.1982, river sand bar (DLPC). BANGLADESH: Rajshahi District: Andharkota, IX.1963 (JSC).

*Ecology*. — Adults are limited to white sandy areas along small to large rivers. Fowler (1912) indicated that adults occurred on sand dunes away from the seashore along the coast of Orissa.

### *Cicindela (Chaetodera) vigintiguttata* Herbst

*Cicindela vigintiguttata* Herbst, 1806:174, pl. 171, fig. 9.

*Type status*. Lectotype, male [here designated]. *Type labels*. "277" [typeset]; "vigintiguttata, Hbst. Dej, Bengal Nietn." [handscript large yellow label with thin black border]; "LECTOTYPE, Cicindela, vigintiguttata Herbst, by R.E. Acciavatti, '84" [typed and handprinted red label]. [Lectotype is 14.5 mm; all appendages intact.] Four (two of each sex) paralectotypes! [here designated] at MNHB, unlabelled except for a male with "datum" [old German script], "vigintiguttata" [handscript], each labelled "PARALECTOTYPE" [typed and handprinted red label]. [These paralectotypes were not submitted to us by MNHB as syntypic; however, the format of the labeling and depository of the specimens is consistent with that of other material considered to represent Herbst's types.] *Type depository*. Lectotype and four paralectotypes at MNHB. *Type locality*. "Ostindien" (undoubtedly northern India).

*Cicindela vigintiguttata* Herbst: Fowler, 1912:416, fig. 180.

*Chaetodera vigintiguttata* (Herbst): Rivalier, 1961:128.

*Pseudochaetodera vigintiguttata* (Herbst): Pajni and Bedi, 1974:940.

*Nomenclatural note*. — This species was described by Herbst under the genus *Chrysonula* which appears to be a typesetting error because he refers to this species as a *Cicindela* everywhere else in his description and illustration. Since the use of this generic name seems to have been unintentional without description, illustration or indication as a new genus, the name is unavailable and a *nomen nudum* (Article 12, ICZN, 1985).

*Diagnosis*. — Distinguished by the medium to large copper and blackish green body; ten white elytral spots; genae and clypeus completely glabrous.

*Description*. — *General habitus*. Body medium to large (14.5–16 mm); head and pronotum copper dorsally, violet laterally; elytra black-green with ten oval or elongate spots; body shiny purple-green ventrally, moderate amounts of thickened decumbent setae on most segments. *Head*. Penicillum of stiff bristles on fourth proximal male antennomere; genae covered by thickened, ventrally directed decumbent setae; labrum short, darkened along anterior edge; single acute medial tooth flanked by one smaller tooth; small patch of decumbent setae above antennal insertion, remainder of vertex



glabrous and finely rugose, nearly smooth medially with coarser parallel rugae near eye; apical tooth of male mandible blunt, inner edge twisted ventrally, that of female acute and straight. *Prothorax*. Sparse, appressed setae laterally on pronotum; proepisterna with dense, appressed white setae on ventral third, glabrous on dorsal third; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a deep pit near dorsal end of posterior margin. *Elytra*. Maculae forming ten oval or elongate yellow-white spots representing a basal dot, sutural band divided into three parts each located on a separate third of the disc, a humeral lunule, middle band divided into three spots and an apical lunule divided in two. *Abdomen*. All sterna covered by thick, decumbent setae laterally, glabrous medially. *Legs*. Trochanters shiny black, glabrous; femora metallic green; tibiae and tarsomeres purple. *Male genitalia*. Aedeagus small, slender, narrow on basal third, abruptly widening at middle to a nearly uniform and maximum width on apical third; apex tapering abruptly to a blunt flattened tip; subapical flange absent.

*Distribution*.—(Fig. 39). Pakistan (Punjab), northern India (Punjab, Uttar Pradesh, Haryana, Bihar, West Bengal, Assam, Sikkim, Orissa), Bhutan and Bangladesh (Dacca).

*Localities*.—INDIA: Uttar Pradesh: Muzaffarnagar, 8.VII.1982 (DLPC, CMNH); Naini Tal, 19.IX.1985, night light (DLPC); Union Territories: New Delhi, 3.II.1957 (DLPC); New Delhi, 23.VII.1962 (CMNH); New Delhi, 12.VIII.1967, light trap (NMNH, CMNH); Punjab: 17 km N Rajpura, 27.VII.1982, grassland (DLPC); Assam: Gauhati, VII.1919 (DLPC); Bihar: Pusa, 8.XI.1927 (DLPC). BANGLADESH: Khulna, VIII.1969 (CMNH).

*Ecology*.—Adults have been found among the tall grass of river flood plains. Fowler (1912) mentioned their presence in rice and millet fields adjoining large river flood plains. Adults are attracted to lights.

### Subgenus *Cicindela* (*Lophyra*) Motschulsky

*Lophyra* Motschulsky, 1861:98.

Type species.—*Cicindela catena* Fabricius, 1775.

*Chaetostyla* Ganglbauer, 1892:11.

Type species.—*Cicindela flexuosa* Fabricius, 1787.

*Cicindela* (*Lophyra*) Motschulsky: Jeannel, 1946:151.

*Lophyra* Motschulsky: Rivalier, 1948:49.

*Lophyra* (*sensu stricto*) Motschulsky: Rivalier, 1961:131.

*Diagnosis*.—*Cicindela* (*Lophyra*) species adults differ from those of other subgenera as follows: 1) male genitalia moderately slender, members of most species with acute apex; convoluted flagellum within the internal sac raising auricular lobes with associated sustained membranes on the right side in left lateral aspect, and on members of some species also in right lateral aspect; 2) body length small to medium (9–12 mm); 3) three acute mandibular teeth distad basal molar; 4) three small labral teeth medially situated; four to six submarginal setae; 5) individuals of some species possess large setal patches behind or in front of each eye; 6) pleural areas covered by decumbent white setae; 7) elytral maculae varied depending upon members of species and subspecies; members of most species possess three lunules broadly fused along the lateral margin, a basal spot and two (on a few specimens one) subsutural markings broadly fused; members of certain species have separated maculae; 8) anterior and middle trochanters each lack subapical seta.

*Included species*.—*Cicindela* (*Lophyra*) contains a large number of species in the Ethiopian and Oriental biogeographic regions of which the following occur on the Indian subcontinent: *C. (L.) catena* Fabricius, 1775; *C. (L.) cerina* (Naviaux



and Acciavatti, 1987); *C. (L.) striatifrons* Chaudoir, 1852; *C. (L.) histrio* Tschitscherine, 1903; *C. (L.) cancellata* Dejean, 1825.

#### Key to adults of *Cicindela (Lophyra)* species

1. Genae setose ..... 2
  - Genae glabrous ..... 4
- 2.(1.) Frons with cluster of decumbent setae above antennal insertion .... 3
  - Frons lacking cluster of setae above antennal insertion ..... *striatifrons* Chaudoir
- 3.(2.) Elytral lunules evident, either connected or separate at lateral margins; pigmented areas extensively touching suture and on a few specimens lateral margin; proepisterna rugose on dorsal half with dense, decumbent setae ..... *catena* Fabricius
  - Elytral lunules entirely obscured by extensive maculation leaving only four, small pigmented areas (anterior area divided in two) situated slightly lateromedially on elytra far removed from suture or lateral margin; proepisterna smooth and glabrous on dorsal half ..... *cerina* (Naviaux and Acciavatti)
- 4.(1.) Labrum with four submarginal setae, medial length long, the longitudinal dimension exceeding half the transverse dimension; vertex of head and pronotum coarsely rugose ..... *histrio* Tschitscherine
  - Labrum with six submarginal setae, medial length short, the longitudinal dimension not exceeding half the transverse dimension; vertex of head and pronotum finely rugose ..... *cancellata* Dejean

#### *Cicindela (Lophyra) catena* Fabricius

*Cicindela catena* Fabricius, 1775:226.

*Type status.* Lectotype, male! [designated by R. Naviaux, 1984a]. *Type labels.* “LECTOTYPE” [printed red label]; “LOPHYRA catena (F.) R. Naviaux det, 1982” [handprinted]. [Only one of two possible female syntypes! at ZMUC conspecific with the lectotype; female [here designated] labelled “PARALECTOTYPE” [printed red label]; the other female is *Cicindela cancellata* Dejean erroneously labelled “PARALECTOTYPE” [printed red label] which is correctly labelled “*Cicindela, cancellata* Dejean, det. R.E. Acciavatti, ’83” (typeset).] [Zimsen (1964) mentioned two other syntypes at ZMUC; one syntypic female! labelled “Ind. Orient. Koenig., *C. catena* Dj., Dr. W. Horn det. 191” was overlooked by Naviaux during his lectotype designation and the other syntype must be considered lost (O. Martin, personal communication, 1983).] *Type depository.* Lectotype and paralectotype at ZMUC. *Type locality.* “Indes Oriental.”

*Cicindela catena* Fabricius: Fowler, 1912:426, fig. 189.

*Lophyra (sensu stricto) catena* (Fabricius): Rivalier, 1961:131.

*Lophyra (sensu stricto) catena insularis* Naviaux, 1984a:15 (preoccupied, Blanchard, 1853:3).

*Type status.* Holotype, male [by original description; unexamined; our concept is based on a paratype! at CMNH]. *Type depository.* Holotype at MNHN. *Type locality.* “Hendala, Sri Lanka.”

*Lophyra (sensu stricto) catena insularis* Naviaux, 1984a:63, fig. 18–20.

*Nomenclatural note.*—Application of the Code (Article 57, ICZN, 1985) to our treatment of *Cicindela (Lophyra)*, establishes *Lophyra (sensu stricto) catena insularis* Naviaux, 1984:15, as a junior secondary homonym of *Cicindela insularis* Blanchard, 1853:3, itself a junior synonym to the Philippine *Cicindela lacrymosa* Dejean, 1825:106. We propose the replacement name *insularisca*, new name, which is feminine singular and derived by adding the Latin diminutive suffix *-isca* to the Latin *insula* (an island) in keeping with its original meaning.

The following published name has been associated with this species: *westerhauseri* Gistel, 1837:61; however, because no description or figure was given, the name is unavailable.

*Diagnosis.*—Distinguished by elytral lunules forming a standard pattern connected at lateral margins on most specimens and separated on others; dull copper areas extensively touching suture on most specimens and also lateral margin on others; setose genae.

*Description.*—*General habitus.* Body medium (10–12 mm); head and pronotum dorsally copper, laterally green or blue; elytra dull copper with a varied pattern of broad yellowish white maculae, most specimens with lunules entirely fused, fewer specimens with lunules partially fused, along the lateral margin; metallic copper ventrally. *Head.* Surface finely rugose; antennal scape with numerous white decumbent setae; labrum short, tridentate, six submarginal setae; genae setose; vertex with cluster of decumbent setae at posterior margin of eyes. *Prothorax.* Pronotum finely rugose; pronotal surface covered by decumbent white setae. *Pterothorax.* Female mesepisternal coupling sulcus a broad groove. *Elytra.* Surface with shallow purple punctures; maculae yellowish white, fused along lateral margin on specimens in certain populations, narrowly joined or separated laterally on specimens in other populations; humeral and apical lunules wide; middle band slightly sinuate, nearly touching suture at distal end; basal spot touching scutellum, joined to sutural band and humeral lunule; sutural band often divided into two elongate spots; apex microserrulate; sutural spine minute; apical margins evenly rounded on male, truncated near suture on female. *Abdomen.* Anterior five sterna on female, six on male, laterally covered by thick decumbent setae; all sterna glabrous medially. *Legs.* Trochanters nonmetallic reddish brown, glabrous; femora, tibiae and tarsomeres metallic copper-green. *Male genitalia.* Aedeagus slender, widest at middle, gradually tapering toward apex; apical tip extremely elongate ending in a tiny acute beak slightly displaced to the right; subapical flange long, uniformly raised for most of its length and symmetrical in both left and right lateral aspects; flange extending from apex nearly to base of apical orifice; apical orifice enlarged and unevenly divided at base to form a broad flap enclosing the opening at its base.

*Geographic variation.*—We recognize two subspecies of *Cicindela catena*: *C. catena catena* a large subspecies with broadly joined lateral elytral maculae; *C. catena insularisca* generally smaller than the nominal subspecies and possesses narrowly joined or separated lateral elytral maculae.

*Distribution.*—(Fig. 42). *Cicindela catena catena* occurs from southern Pakistan (Sind) and India (Rajasthan, Punjab) generally through southern and eastern India and Sri Lanka; *Cicindela catena insularisca* is confined to Sri Lanka.

*Localities.*—*Cicindela catena catena*. INDIA: Karnataka: 30 km S Bangalore, 12.VI.1983, old field (DLPC); Bangalore, 1.VI.1984, sandy river bank (DLPC); Bangalore, 19.V.1985, scrub forest floor (DLPC); Sandur, 13–14.VII.1986, scrub forest (DLPC); Haryana: 10 km S Chandigarh, 26.VII.1982, grassland (DLPC); Tamil Nadu: Coimbatore, 430 m, VIII, IX, X.1971 (CMNH); Marudamalai Range, X.1971 (CMNH); 25 km S Pollachi, 19.VI.1983, old field (DLPC); 10 km N Salem, 27.VI.1984, old field (DLPC); 16 km S Karur, 6.XI.1984 (DLPC); Kodaikanal, 29.IX.1985, old field (DLPC); 27 km N Pudukkottai, 26.IX.1986, scrub forest (DLPC); 8 km SE Madurai, 22.IX.1986, scrub forest (DLPC); Point Calimere, 20.X.1987, ocean beach (DLPC); Tirunelveli District, Manapad, X.1986 (CMNH); South Arcot, Aurouilli Forest, IX.1983 (CMNH); Union Territory: Pondicherry, sea level, VIII.1984 (CMNH); Kerala: Poonmudi Range, IX.1971 (CMHN); Andhra Pradesh: 12 km N Elura, 17.VIII.1985, old field (DLPC); 65 km N Waltair, 29.VI.1986, scrub forest (DLPC); 57 km W Hyderabad, 4.VII.1986, scrub forest (DLPC); Bihar: 85 km W Ranchi, 23.VI.1986, scrub forest (DLPC); 17 km S Hazaribagh, 21.VI.1986, scrub forest (DLPC); Uttar Pradesh: Jhansi District, Babina, 290 m, VIII.1987 (CMNH). *Cicindela catena insularisca*. SRI LANKA: Mannar District: Kandachchi, 15.IV.1981 (DLPC); Matugama, 20.IV.1981 (RNC, CMNH); Labugama, 16.VIII.1979 (RNC, CMNH); Western Province: Bentota Ganga, Alutgama, 0 to 3 m, 20–31.X.1984 (JPC, CMNH).

*Ecology.*—Adults occur away from water in upland areas of open grassland, old fields and along dirt roads. Naviaux (1984b) found this species in Sri Lanka on dry warm sand near the margins of rivers and lagoons by the ocean, as well as in large sunny forest clearings.

*Cicindela (Lophyra) cerina* (Naviaux and Acciavatti)

*Lophyra cerina* Naviaux and Acciavatti, 1987:83, fig. 1–6.

*Type status.* Holotype, male [by original description; unexamined; paratypes! at CMNH]. *Type depository.* Holotype at MNHNP. *Type locality.* "India, Tamil Nadu, Turinelveli District, Manapad, 2–3 km. south of Kulasekarapattinam."

*Diagnosis.*—Distinguished by elytral lunules entirely obscured by extensive waxy colored maculation leaving only four small blue areas on disc; genae setose; frons with setal patches above antennal insertion.

*Description.*—*General habitus.* Body small to medium (9–10.5 mm); body form slightly robust; head and pronotum brilliant copper-red; elytra yellowish orange with a waxy luster; five small cobalt blue spots medially situated and a sutural band of the same color; body nonmetallic testaceous ventrally. *Head.* Surface finely rugose; labrum ivory, anterior edge dark; tridentate; four to five submarginal setae; frons with setal patch above antennal insertion, remainder glabrous; genae setose. *Prothorax.* Pronotal surface densely rugose, covered by scattered decumbent setae; proepisterna smooth, glabrous over most of its dorsal surface; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a narrow, slightly arcuate groove at middle, absent near ventral margin. *Elytra.* Surface waxy yellow-orange from extremely expanded lunules; cobalt blue pigmentation in five small, medial areas (basal two smallest side by side, other three in a medial row) and along suture; apex microsculptured; sutural spine small; apical margins separately rounded on female, cojointly rounded on male. *Abdomen.* Sterna laterally covered by decumbent white setae; sterna glabrous medially. *Legs.* Trochanters reddish testaceous, glabrous; femora, tibiae and tarsomeres entirely reddish testaceous; tarsal spines unusually long. *Male genitalia.* Aedeagus shape slightly bulky, gradually tapering to an elongate tip; subapical flange symmetrical in both left and right lateral aspects, long and uniformly raised for most of its length, and extending from below apex about halfway to base of apical orifice; apical orifice enlarged, curved ventrally from middle to base to form a broad bulge enclosing the genital opening at its base.

*Distribution.*—(Fig. 42). Known only from the type locality of India, Tamil Nadu, Turinelveli District, along the Gulf of Mannar.

*Localities.*—INDIA: Tamil Nadu: Turinelveli District, Manapad, 2 to 3 km south of Kulasekarapattinam, X.1986 (CMNH).

*Ecology.*—Adults occur during October along the Gulf of Mannar only on open places on dry, light yellow or creamy colored sands, ½ to 1 km from the coast (T. R. S. Nathan, personal communication, 1987). *Cicindela catena* was found nearby on whitish sand nearer the coast, but not together with *C. cerina*.

*Cicindela (Lophyra) striatifrons* Chaudoir

*Cicindela striatifrons* Chaudoir, 1852:12.

*Type status.* Holotype, male [by original description; unexamined; concept based on comparison of original description with specimens! from India, Union Territory, Chandigarh, 16.VII.1982, grassland, at DLPC]. *Type depository.* ?MNHNP. *Type locality.* "Indes Orientales."

*Cicindela striatifrons* Chaudoir: Fowler, 1912:426, fig. 190.

*Lophyra (sensu stricto) striatifrons* (Chaudoir): Rivalier, 1961:131.

*Lophyra (sensu stricto) striatifrons* (Chaudoir): Naviaux, 1985:65, fig. 12, 41.

*Diagnosis.*—Distinguished by the standard pattern of elytral maculae; lunules separated at lateral margin; genae setose; frons glabrous on most specimens; a few specimens with one or two setae near antennae.

*Description.*—*General habitus.* Body small to medium (9–10.5 mm); head and pronotum copper; elytra dull blackish green with a broad, standard pattern of maculae; all lunules separated laterally; body metallic copper ventrally. *Head.* Labrum short, ivory; anterior margin with three small medial teeth, six submarginal setae; vertex moderately rugose; rugae parallel near eyes, arcuate at middle; finely impressed rugae on frons medially; decumbent setal patch behind each eye; genae covered by

white decumbent setae; frons on most specimens entirely glabrous, a few specimens with one or two setae above antennal insertion; antennal scape with decumbent setae; fourth male antennomere with a penicillum of several stiff bristles. *Prothorax*. Pronotal surface with shallowly impressed, irregular rugae; anterior and posterior transverse sulci shallowly impressed; pronotum nearly covered by sparse decumbent setae lacking on either side of middle but abundant along a broad lateral margin where they originate from large setigerous punctures; proepisterna copper-red, smooth with only shallow wrinkles and entirely glabrous on dorsal half; ventrally with semierect setae; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a short, moderately deep and elongate groove medially along posterior margin. *Elytra*. Dark areas with shallow purple punctures only slightly contrasting with remainder of surface; maculae forming a broad, standard pattern of lunules separated laterally; sutural band divided into two spots; apex with large microserrulations; sutural spine small; apical margins conjointly rounded on male, separately and acutely rounded near suture on female. *Abdomen*. Sterna laterally covered by decumbent white setae; sterna glabrous medially. *Legs*. Trochanters nonmetallic reddish brown, glabrous; femora, tibiae and tarsomeres metallic copper, purple and green. *Male genitalia*. Aedeagus short, stocky, widest at middle and tapering on distal half before abruptly tapering to a short acute apex; subapical flange long, slightly raised and symmetrical in both left and right lateral aspects, extending halfway to base of apical orifice; apical orifice curved ventrally near base, dorsal margin irregular.

*Distribution*.—(Fig. 43). India (Punjab, Uttar Pradesh, West Bengal, Bihar, Orissa, Karnataka) and Nepal; a doubtful record from Karnataka (Heynes-Wood and Dover, 1928).

*Localities*.—INDIA: Union Territory: Chandigarh, 1, 3.VII.1983, grassland (DLPC, CMNH); Chandigarh, 24.VII.1982, grassland (DLPC); Punjab: 17 km N Rajpura, 27.VII.1982, grassland (DLPC). NEPAL: Basse vallée de la Buri Gandaki, 500 to 1000 m, 29.VII.1982 (Naviaux, 1985).

*Ecology*.—Adults are found in open sandy areas among tall grasses. Reported by Fowler (1912) from the sand and muddy grass margins of rivers in jungle forests.

### *Cicindela (Lophyra) histrio* Tschitscherine

*Cicindela (Chaetostyla) histrio* Tschitscherine, 1903:16.

*Type status*. Lectotype, female [here designated]. *Type labels*. "Chorsan: Neh-i-Bendan, 9.V.1898, N. Zarudny" [first and last lines typeset in Cyrillic, middle manuscript]; "histrio m., type., Tschitscherin det" [first two lines manuscript, last typeset]; "LECTOTYPE, *Cicindela (Chaetostyla), histrio* Tschitscherin, by R.E. Acciavatti, '85" [typed and manuscript red label]. [Lectotype is 11.5 mm; all appendages intact.] Paralectotypes, male with the same collection data as the lectotype, male with the locality label "Chorasan, 20-22.VII.1901, N. Zarudny" [first and last lines Cyrillic, middle manuscript], each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depositary*. Lectotype and two paralectotypes at DEI. *Type locality*. "Chorasan, Zirkuh Region" (Iran).

*Cicindela histrio* Tschitscherine: Fowler, 1912:425, fig. 188.

*Lophyra (sensu stricto) histrio* (Tschitscherine): Rivalier, 1961:131.

*Lophyra (sensu stricto) histrio* (Tschitscherine): Naviaux, 1983:80, fig. 5, 33, 57.

*Diagnosis*.—Distinguished by the standard elytral pattern with lunules fused laterally; head and pronotum coarsely rugose; glabrous genae; labrum long with four submarginal setae.

*Description*.—*General habitus*. Body medium (10.5–12.5 mm); head and pronotum coarsely rugose and copper; elytra dull, copper-green with a standard pattern of maculae fused laterally; body copper ventrally. *Head*. Frons and vertex coarsely rugose; parallel ridges near eyes, arcuate medially; antennal scape with numerous white, decumbent setae; labrum long, tridentate; four submarginal setae; genae glabrous. *Prothorax*. Pronotum coarsely rugose, covered by decumbent setae; proepisterna with thick, long decumbent setae on ventral half, extending to cover lateral part of prosternum near coxae; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a short groove dorsally, broad and indistinct ventrally. *Elytra*. Dark area dull, copper-green; maculae yellow-white forming a standard pattern; lunules joined laterally, connected through basal dot to sutural band, the latter complete on most specimens, separated on a few others; discal end of middle band nearly touching suture; large

microserulations; sutural spine small; apical margin straight on male, evenly rounded on female. *Abdomen*. Sterna laterally with abundant white, decumbent setae; sterna glabrous medially. *Legs*. Trochanters reddish testaceous, glabrous; femora, tibiae and tarsomeres metallic copper-green and purple. *Male genitalia*. Aedeagus short, bulky and uniformly wide on apical half, tapering abruptly to a short rounded tip; subapical flange evident only in left lateral aspect, short, only slightly raised; apical orifice long, extending from near tip to middle, broad ventral curve defining a long ventral flap at middle of opening.

*Distribution*.—(Fig. 42). India (Rajasthan) and Pakistan (Sind) westward into Afghanistan and Iran. Naviaux (1983) considered this species to be quite common in Iran where he encountered it at numerous localities.

*Localities*.—PAKISTAN: Karachi, 25.IX.05 (DED); INDIA: Rajasthan: Lake Sambhar, 17.VIII.1987 (KWC). IRAN: Dehnow, 8.VI.1973 (RNC, FCC).

*Ecology*.—Naviaux (1983) found adults of this species on sandy areas bordering rivers, irrigation canals and flooded fields from April to June. They occur also around lakes and reservoirs.

### *Cicindela (Lophyra) cancellata* Dejean

*Cicindela cancellata* Dejean, 1825:116.

*Type status*. Syntypes(?) [unexamined; concept based on comparing original description with specimens! labelled "India, Tamil Nadu, 25 km W Coimbatore, 18.VI.1983, sandy river beach" at DLPC]. *Type depository*. ?MNHNP. *Type locality*. "Java."

*Cicindela catena cancellata* Dejean: Horn, 1891:324.

*Cicindela cancellata* Dejean: Fowler, 1912:425, fig.188.

*Lophyra (sensu stricto) cancellata* (Dejean): Rivalier, 1961:131.

*Cicindela cancellata viridula* Mandl, 1982a:65 (preoccupied, Quenzel, 1806:243).

*Type status*. Holotype, male! [by original description]. *Type depository*. Holotype at BMNH. *Type locality*. "Gielle Khola, Tista Valley, British Sikkim."

*Lophyra (sensu stricto) cancellata* (Dejean): Naviaux, 1984b:63, fig. 15–17.

*Nomenclatural note*.—*Cicindela cancellata viridula* is preoccupied by *C. viridula* Quenzel, 1806:243, which Horn (1926) placed in *Prothyma*. For Mandl's subspecies, we propose the replacement name, *Cicindela (Lophyra) cancellata intemperata*, new name, which is feminine singular and derived from the Latin *intemperatus* (excessive) with reference to the enlarged greenish areas of the elytra.

*Diagnosis*.—Distinguished by the standard elytral pattern; lunules fused laterally, either broadened or narrowed depending on subspecies; glabrous genae; labrum short, six submarginal setae; finely rugose head and pronotum.

*Description*.—*General habitus*. Body medium (10–11 mm); head and pronotum copper to copper-green; elytra dull, dark copper-green to green or blue-green; standard pattern of elytral maculae varied from broadened to narrowed (refer to geographic variation); body copper ventrally. *Head*. Antennal scape with numerous decumbent setae; labrum short, tridentate, six submarginal setae; frons with numerous, fine longitudinal rugae; genae glabrous; vertex finely rugose, numerous arcuate rugae medially, those next to eyes deepest and parallel; appressed, white setal patch behind each eye. *Prothorax*. Pronotum quadrate; pronotal surface covered by scattered, decumbent setae, finely to moderately wrinkled; anterior and posterior transverse sulci shallow medially, deepest and blue-green laterally in contrast to copper surface; pronotum sparsely setose; proepisterna copper, polished, glabrous on dorsal third, remainder covered by appressed, white setae. *Pterothorax*. Female mesepisternal coupling sulcus a dorsal groove on most specimens, deepened to form a shallow depression at dorsal end on some specimens; mesepisterna glabrous except for appressed, white setae on ventral third. *Elytra*. Maculae ivory, outlined with blue or black, pattern standard, varied in width (refer to geographic variation); elytral surface dull with numerous, shallow contrasting blue-green punctures; lunules either broadly or narrowly connected laterally; humeral lunule joined or separated from the lateral expansion of the

middle band; on most specimens apical lunule connected to lateral extension of middle band and humeral lunule separate from basal dot; sutural band may be complete or divided in two with basal portion on most specimens joined to basal dot but broadly marked individuals exist with these maculae separate; apex with large microsculptulations; sutural spine large; apical margin evenly rounded on male, only slightly truncated near suture on female. *Abdomen*. Anterior six sterna on male, five on female with abundant, white decumbent setae; sterna medially glabrous. *Legs*. Trochanters nonmetallic reddish or black-brown, glabrous; femora metallic copper-green; tibiae purple; tarsomeres copper-green. *Male genitalia*. Aedeagus short bulky, widest apically, short rounded apex; subapical flange absent; apical orifice short and confined to the truncated portion of the apex; parameres extending beyond middle.

*Geographic variation*.—This species is varied in dorsal color and pattern of elytral maculae throughout its range, but only those populations from the Indian subcontinent will be discussed. We have not seen the syntype of nominal *Cicindela cancellata*. Our concept of it is based on specimens! with copper head and pronotum and dull dark copper-green elytra with broadened maculae; these characters predominate in southern India (Tamil Nadu, Karnataka). Specimens with copper-green, green or blue-green head and pronotum and elytra with narrow maculae predominate in northern parts of the Indian subcontinent (West Bengal, India, and Nepal). Specimens from Gujarat, India, possess narrowed elytral maculae and a predominately green elytral surface similar to specimens from Nepal, and West Bengal and Assam, India. All these northern populations are here referred to as *Cicindela cancellata intemperata*. Additionally, in southern populations, the apical end of the middle band extends posteriorly beyond the basal end of the apical lunule, whereas in northern populations, these two maculae barely meet one another. Populations from eastern India are intermediate in this character.

*Distribution*.—(Fig. 43). *Cicindela cancellata cancellata* is widely distributed in southern India (Maharashtra, Karnataka, Kerala, Tamil Nadu), Sri Lanka and Bangladesh eastward into Southeast Asia as far south as Malaysia (Naviaux, 1987) and southern China. *Cicindela cancellata intemperata* occurs from Pakistan (Sind, Punjab) across northern India (Gujarat, Uttar Pradesh, Haryana, West Bengal, Assam), Nepal, and Sikkim eastward into Thailand. Intermediate forms are found in eastern India (Bihar, West Bengal, Orissa, Madhya Pradesh, Andhra Pradesh).

*Localities*.—*Cicindela cancellata cancellata*. INDIA: Kerala: 15 km E Palghat, 19.V.1985, sandy river beach (DLPC); 10 km E Nilambur, 30.X.1984 (DLPC); Tamil Nadu: 60 km N Madurai, 18.V.1984, sandy river beach (DLPC); 10 km E Musiri, 25.VII.1986, sandy river bank (DLPC); Madurai, 14.XI.1984 (DLPC); Coimbatore, 430 m, VIII.1957 (CMNH); Walayar Forests, 215 m, X.1972 (CMNH); Karnataka: 10 km N Kanakapura, 1.VI.1984, sandy river beach (DLPC); 60 km W Dharwar, 27.V.1985, sandy river beach (DLPC); 9 km S Belthangady, 20.XI.1984 (DLPC); Karwar, sea level, 12.VI.1987, ocean beach (DLPC); Union Territory: 7 km S Pondicherry, 22.I.1985 (DLPC). *Cicindela cancellata intemperata*. INDIA: Gujarat: 18 km SE Pavagarth, 10.X.1984 (DLPC); Uttar Pradesh: 20 km NE Saharanpur, 28.VI.1983, old field (DLPC); Haryana: Sultanpur, 6.VIII.1988, moist grassland (DLPC); West Bengal: 25 km N Siliguri, 2.VI.1985, sandy river beach (DLPC); Assam: Kaziranga, Vohora, 2.V.1985 (DLPC); NEPAL: 15 km S Sauraha, 28.V.1986, grassy sand pit (DLPC); Chitwan District: Chitwan Road and Lothar River, IX.1971 (CMNH); Murkutwa, 150 m, 15.V.1984 (RNC, CMNH); 17 km E Itahari, 150 m, 14.V.1984 (RNC, CMNH). SRI LANKA: Kurunegala District: Kurunegala, 14.VIII.1979, 25.IV.1981, 6.IX.1983 (Naviaux, 1984b); Polonnaruwa District: Mahaweli Ganga, 27, 28.IV.1981 (Naviaux, 1984b); Puttalam District: Kala Oya, 2–4.V.1981, 9.IX.1983 (Naviaux, 1984b). THAILAND: Nikom Kamsoy, Mukdaharn, IV.1985 (HSC). *Intermediate form*. INDIA: Madhya Pradesh: Kanha National Park, 16.VI.1982 (DLPC); Andhra Pradesh: 30 km N Narsipatnam, 28.VI.1986, sandy river bank (DLPC); 29 km E Narsipatnam, 28.VI.1985, sandy river bank (DLPC); Araku Valley, 900 m, 23.VIII.1985, sandy river bank (DLPC); Bihar: 17 km N Hazaribagh, 21.VI.1986, sandy river bank (DLPC).

*Ecology*.—Adults are found on dry upper sandy banks along medium to large rivers.

*Remarks*.—*Cicindela (Lophyra) cancellata* and *C. (Lophyra) catena*, although

confused by Horn (1891) and Fowler (1912), exhibit distinctive morphology and habitat preference. Adult males of the former species have a short and rounded aedeagal apex, whereas adult males of the latter species have an extremely elongate aedeagal apex. The female mesepisternal coupling sulcus of each species also differs; for the former species it is narrowly grooved dorsally, for the latter broadly and indistinctly grooved. Each species occupies a distinctly different habitat; the former on dry sandy upper river banks, the latter in open uplands away from water.

### Subgenus *Cicindela* (*Spilodia*) Rivalier

*Lophyra* (*Spilodia*) Rivalier, 1961:131.

Type species.—*Cicindela striolata* Illiger, 1800.

**Diagnosis.**—*Cicindela* (*Spilodia*) species adults are closely related to those of *Cicindela* (*Lophyra*) based on the similar male genitalia; moderately slender aedeagus with rounded apex; convoluted flagellum within the internal sac forming auricular lobes on the right side in left lateral aspect raising sustained membranes. The following adult morphological features distinguish *Cicindela* (*Spilodia*) species: 1) body small to medium in length (9–12 mm); 2) mandibles distad basal molar with four acute teeth, the middle one on most specimens smallest; 3) labrum with three or five small to moderately long teeth; four to six submarginal setae; 4) head glabrous on frons and vertex; 5) pleural areas with sparse, appressed setae in varied numbers; 6) elytra typically possess three separate lunules not expanded along the lateral margin, a basal spot and two (in a few species some individuals have one or several) subsutural markings all of which are widely separated; 7) elytral epipleura darkened and metallic along their entire length; 8) front and middle trochanters each possessing a subapical seta on adults of certain species, including the type species *Cicindela striolata* Illiger, but lacking a subapical seta on those of other species.

**Included species.**—The species of *Cicindela* (*Spilodia*) are confined to the Oriental biogeographic region and include the following from the Indian subcontinent: *C. (S.) striolata* Illiger, 1800; *C. (S.) lineifrons* Chaudoir, 1865; *C. (S.) parvima-culata* Fowler, 1912; *C. (S.) lefroyi* Horn, 1908; *C. (S.) vittigera* Dejean, 1825; *C. (S.) multiguttata* Dejean, 1825.

### Key to adults of *Cicindela* (*Spilodia*) species

1. Front and middle trochanters each with a subapical seta ..... 2
  - Front and middle trochanters lacking a subapical seta ..... 3
- 2.(1.) Humeral elytral lunule narrow and separated from middle spot; female and male labrum tridentate; genae glabrous on most specimens, sparsely setose on others; only anterior three abdominal sterna with dense lateral setae ..... *lineifrons* Chaudoir
  - Humeral elytral lunule wide, on most specimens extending to, on other specimens fused with, middle spot; female labrum five-toothed, male labrum with three to five teeth; genae moderately setose; anterior four to five abdominal sterna with dense lateral setae ..... *striolata* Illiger
- 3.(1.) Genae setose ..... 4
  - Genae glabrous ..... 5
- 4.(3.) Elytral maculae with humeral lunule long, terminating almost at middle band; middle band of uniform width at its apical end ... *vittigera* Dejean



- Elytral maculae with humeral lunule short, not terminating at middle band; middle band with a bulge at its apical end . . . *multiguttata* Dejean
- 5.(3.) Antennal scape with one to a few erect seta(e) besides primary seta at distal end . . . . . *lefroyi* Horn
- Antennal scape glabrous except for a primary seta at distal end . . . . . *parvimaculata* Fowler

***Cicindela (Spilodia) striolata* Illiger**

*Cicindela striolata* Illiger, 1800:114.

*Type status.* Lectotype, female [here designated]. *Type labels.* “282” [typeset]; “Type” [typeset orange label]; “semivittata Fab.\*Schm-Goeb., striolata Illig.\*, vigorsii Dej., Sumatr., Daldorf” [handscript yellow label]; “Zool. Mus. Berlin” [typeset]; “LECTOTYPE, *Cicindela, striolata* Illiger, by R.E. Acciavatti, ’83” [typed and handprinted red label]. [Lectotype is 12 mm.] *Type depository.* Lectotype at MNHB. *Type locality.* “Sumatra.”

*Cicindela semivittata* Fabricius, 1801:237.

*Type status.* Lectotype, male [here designated]. *Type labels.* [Small green square]; “Type” [typeset red label]; “Sumatra, Daldorf, Mus. S: and T:L., striolata. Illig., *Cicindela semivittata*. F.” [handscript]; “LECTOTYPE, *Cicindela, semivittata* Fabricius, by R.E. Acciavatti, ’83” [typed and handprinted red label]. [Lectotype is 12 mm; previously pinned through left elytron.] *Type depository.* Lectotype at ZMUC. *Type locality.* “Sumatra.”

*Cicindela vigorsii* Dejean, 1831:223.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* ?MNHNP. *Type locality.* “Indes Orientales.”

*Cicindela dorsolineolata* Chevrolat, 1845:95.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* ?MNHNP. *Type locality.* “Macao, China.”

*Cicindela dorsolineata (sic)* Illiger: Schaum, 1863:65.

*Cicindela striolata* Illiger: Fowler, 1912:419, fig. 183.

*Cicindela striolata striolata* Illiger: Horn, 1915:306.

*Lophyra (Spilodia) striolata* (Illiger): Rivalier, 1961:131.

*Lophyra (Spilodia) striolata* (Illiger): Naviaux, 1985:65, fig. 13, 43, 74.

**Diagnosis.**—Distinguished by wide humeral lunule and middle spot fused on most specimens; male labrum five-toothed; genae moderately setose; front and middle trochanters each with a subapical seta.

**Description.**—*General habitus.* Body medium (10–15 mm); head and pronotum copper, laterally bright copper-green, blue-green and purple; elytra velvety black or greenish black; white or yellow maculae forming a varied pattern of divided and complete lunules and bands (refer to geographic variation); body shiny black ventrally. *Head.* Female labrum long, five-toothed, male labrum short, three to five teeth; broadly raised medial carina; anterior labral margin broadly and posterior margin narrowly darkened; four submarginal labral setae; vertex moderately rugose with numerous parallel ridges becoming slightly arcuate at middle; frons with fine parallel rugae, almost inconspicuous; frons and vertex glabrous; genae moderately setose. *Prothorax.* Pronotum subquadrate, arcuate laterally, widest behind anterior transverse sulcus on female, at middle on male; pronotal surface sculpturing with fine and irregular rugae except at extreme edge which is smooth; anterior transverse sulcus moderately impressed laterally, shallowly impressed at center, posterior sulcus moderately impressed throughout; pronotum with sparse appressed setae originating from small setigerous punctures in a band along entire anterolateral margin except for extreme glabrous edge; proepisterna copper-red, polished and nearly glabrous except for scattered setae anteroventrally originating from small setigerous punctures; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a shallow to moderately deep circular pit or elongate groove medially. *Elytra.* Surface impunctate without contrasting flecks on disc; macular pattern varied (refer to geographic variation); on most specimens consisting of complete humeral lunule, divided middle band and apical lunule, elongate basal spot, sutural band



divided in two; on some specimens maculae form a long, irregular sublateral stripe representing a fusion of humeral lunule with middle band which in turn nearly joins anterior portion of divided apical lunule; on a few specimens humeral lunule separate and middle band fused to apical lunule; epipleura shiny black with slight metallic reflections; apex with small microsculptulations; sutural spine moderately long in both sexes; apical margins evenly and conjointly rounded on male, slightly separately rounded near suture on female. *Abdomen*. Anterior four sterna on female and five on male with dense, appressed setae laterally, glabrous over remainder of the surface. *Legs*. Trochanters nonmetallic, shiny brownish black, one subapical seta on each front and middle segment; femora metallic copper-green; tibiae and tarsomeres purple-black. *Male genitalia*. Aedeagus short, moderately stout, uniformly wide on apical third; apex tapering abruptly to a short rounded tip slightly displaced to the right side; subapical flange absent.

*Geographic variation*.—Throughout its range, this species is varied with many named subspecies poorly differentiated from each other. An analysis of the validity of these subspecies is beyond the scope of our review. Only the nominal subspecies is found on the Indian subcontinent. There is a tendency for specimens of *Cicindela* (*Spilodia*) *striolata* from southern India to have smaller, separate markings with the humeral lunule thinner and on a few specimens joined to the middle band, thereby superficially resembling *C. (Spilodia) lineifrons*.

*Distribution*.—(Fig. 44). Widely distributed in the Oriental biogeographic region as several named subspecies. Only the nominal subspecies occurs throughout India (Maharashtra, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Himachal Pradesh, Madhya Pradesh, Bihar, Orissa, West Bengal, Sikkim, Meghalaya, Assam), Nepal and Bangladesh.

*Localities*.—INDIA: Karnataka: Shimoga District, Agumbe Ghat, 615 m, V.1981 (CMNH); Coorg District, Mercara, 1230 m, V.1973 (CMNH); 5 km N Mudigere, 5.VI.1984, road cut (DLPC); 20 km SW Chikmagalur, 6.VI.1984, forest path (DLPC); 60 km W Belgaum, 28.V.1985, forest path (DLPC); Sringeri, 850 m, 14.VI.1987, forest path (DLPC); Kerala: Trichur District, Peechi, V.1979 (CMNH); Periyar, 16.V.1984, forest path (DLPC); Kottayam, Peermade, VI.1975 (CMNH); Quilon District, Tenmalai, 27.V.1986, forest path (DLPC); 35 km N Palghat, 300 m, 21.VIII.1986, forest path (DLPC); Tamil Nadu: Mudumalai Refuge, 14.VI.1983, forest path (DLPC); Anaimalai Hills, Topslip, 770 m, V.1977 (CMNH); Nilgiri Hills, Devala, 985 m, V.1974 (CMNH); Uttar Pradesh: 15 km N Dehra Dun, 30.VI.1983, forest path (DLPC); 15 km S Dehra Dun, 10.VII.1982 (DLPC); Madhya Pradesh: Kanha National Park, 16.VI.1982, forest path (DLPC); West Bengal: 15 km N Siliguri, 3.VI.1985, forest path (DLPC); Maharashtra: 10 km W Thane, 28.VI.1985, forest path (DLPC); 5 km W Ajra, 16.VII.1986, forest path (DLPC); Goa: 70 km W Belgaum, 28.V.1985, forest path (DLPC); Bihar: Ranchi, 20.VI.1986, scrub forest (DLPC); 20 km S Palamau, 22.VI.1986, scrub forest (DLPC); Orissa: Simlipal National Park, 24–25.VI.1986, forest path (DLPC); Andhra Pradesh: 15 km N Salur, 30.VI.1986, scrub forest (DLPC); 30 km E Warangal, 5.VII.1986, scrub forest (DLPC). NEPAL: 15 km S Sauraha, 28.V.1986, forest path (DLPC); 12 km E Kankarvitta, 150 m, 4, 5.V.1984 (RNC, CMNH); Janakpur, Tamba-Koshi Khola, SE Charicot, 900 to 1200 m, 16–25.VI.1987 (JPC, CMNH).

*Ecology*.—Adults found in secondary growth and open climax forests; occasionally in road cuts and open areas away from forests during the monsoon rains. Naviaux (1985) often encountered this species along forest paths of the Terai in Nepal.

### *Cicindela (Spilodia) lineifrons* Chaudoir

*Cicindela lineifrons* Chaudoir, 1865:62.

*Type status*. Syntype(s)? [unexamined; concept based on comparison of original description with specimens! labelled "India, Uttar Pradesh, 15 km N Dehra Dun, 30.VI.1983, forest path" at DLPC]. *Type depository*. ?MNHN. *Type locality*. "Cambodia."

*Cicindela lineifrons interrupta* Fleutiaux, 1902:569 (*nec* Fabricius, 1775:225).

*Type status*. Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository*. ?MNHN. *Type locality*. "Tonkin and Laokay" (Vietnam and Laos).

*Cicindela striolata lineifrons* Chaudoir: Fowler, 1912:421, fig. 184.

*Lophyra (Spilodia) lineifrons* (Chaudoir): Rivalier, 1961:132.

*Lophyra (Spilodia) lineifrons* (Chaudoir): Naviaux, 1985:65, fig. 14, 44, 75.

**Diagnosis.**—Distinguished by narrow maculae; humeral lunule separated from middle spot; front and middle trochanters each with subapical seta; genae glabrous on some specimens, a few setae present on others.

**Description.**—*General habitus.* Body medium (10–13 mm); head and pronotum bright copper; elytra velvety black; standard although fragmented pattern of white or yellow maculae; body shiny black ventrally. *Head.* Antennal scape glabrous except for subapical primary seta; labrum with an abrupt medial carina; female labrum with five teeth, male labrum with three teeth on most specimens, five teeth on a few; labral and teeth length longer on female than on male; darkened area along anterior margin broadened to encompass majority of surface; four submarginal setae; vertex, frons glabrous; genae glabrous on some specimens, a few setae on others. *Prothorax.* Pronotum longer than wide, moderately rugose; anterior transverse sulcus shallowly impressed at middle, posterior transverse sulcus moderately impressed throughout; pronotal surface mostly glabrous, only sparsely setose laterally; proepisterna copper-red, smooth and polished, almost entirely glabrous except for a few scant setae ventrally; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a shallow, circular pit medially. *Elytra.* Surface minutely granulate-punctate, punctures noncontrasting, granules more evident basally becoming nearly impunctate apically; maculae white, narrow, separated, forming complete humeral lunule, basal dot, extremities of middle and sutural bands, and apical lunule; epipleura shiny black; apex with small microserrulations; sutural spine small; apical margins separately rounded on each sex but more so on female. *Abdomen.* Only first three abdominal sterna with dense lateral setae on each sex; remaining surfaces glabrous. *Legs.* Trochanters nonmetallic dark brown, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic greenish bronze and purple. *Male genitalia.* Aedeagus moderately slender, slightly bulky, widest at middle and uniformly tapering apically to end in a short acute tip displaced slightly to the right; subapical flange symmetrical in both left and right lateral aspects, extending from apex medially a short distance before ending abruptly; parameres extending beyond middle of aedeagus.

**Distribution.**—(Fig. 44). Northern India (Uttar Pradesh, Meghalaya, West Bengal, Assam), Nepal and Bangladesh (Chittagong Hill Tracts) eastward into Southeast Asia. Erroneously reported by Fowler (1912) from Karnataka and Tamil Nadu, India.

**Localities.**—INDIA: Uttar Pradesh: 15 km N Dehra Dun, 29.VI.1983, forest path (CMNH); 15 km S Dehra Dun, 10.VII.1982 (DLPC, CMNH). NEPAL: 6 km S Dharan-Bazar, 9.V.1984 (RNC, CMNH); Bhadrapur, 120 m, 12.V.1984 (RNC, CMNH).

**Ecology.**—Sympatric with *Cicindela striolata* in Uttar Pradesh near Dehra Dun, India, in climax forests. These two species are also reported together in Nepal (Naviaux, 1985) and in Malaysia (Naviaux, 1987) along forest paths.

**Remarks.**—This species, elevated from a subspecies of *Cicindela striolata* by Rivalier (1961), superficially resembles populations of *C. striolata* found in southern India. The two species are sympatric only in northern India, where the separate markings of *Cicindela lineifrons* permit its recognition.

### *Cicindela (Spilodia) parvimaculata* Fowler

*Cicindela striolata parvimaculata* Fowler, 1912:421, fig. 185.

**Type status.** Holotype, female! [by monotypy]. **Type depository.** Holotype at BMNH. **Type locality.** “Dhargeely” (Darjeeling, West Bengal, India).

*Cicindela parvimaculata* Fowler: Horn, 1926:186.

**Diagnosis.**—Distinguished from *C. lineifrons* by glabrous genae; glabrous front and middle trochanters; penicillum on fourth male antennomere.

**Description.**—*General habitus.* Body medium (14–15 mm); head and pronotum copper-brown dorsally, shiny blue-green laterally and in transverse sulci on pronotal disc; elytra velvety black or greenish

black; white or yellow maculae forming standard but fragmented pattern, reduced in size and shape to circular or elongate spots; body shiny blackish green ventrally. *Head*. Antennal scape glabrous, except for primary setae; penicillum of numerous stiff bristles; labrum long, three marginal teeth on each sex, middle tooth on male minute; labral surface darkened narrowly along anterior margin, remainder testaceous; six submarginal labral setae; medial carina abrupt on female, broader on male; rugae on vertex forming moderately raised, parallel ridges near eyes; rugae on frons finely raised medially; vertex, frons and genae glabrous. *Prothorax*. Pronotum slightly longer than wide; surface sculpturing smooth, scarcely wrinkled; anterior transverse sulci shallowly impressed at middle, posterior transverse sulci moderately impressed throughout; sparse decumbent setae scattered over pronotal surface, except on either side of middle and on posterior reflexed margin; pronotal setae most abundant laterally, originating from large setigerous punctures submarginally; proepisterna with shallow parallel wrinkles dorsally, entirely glabrous on dorsal half, sparse decumbent setae on ventral half; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a broad groove. *Elytra*. Surface granulate-punctate with minute granules and shallow purple punctures contrasting with copper-green color throughout; suture metallic copper; maculae greatly fragmented, representing basal dot, extremities of humeral and apical lunules, divided middle band and sutural band; apex with small microsculptulations; small acute sutural spine; apical margins cojointly rounded on male, separately rounded at suture on female. *Abdomen*. Anterior five sterna on each sex covered by decumbent white setae laterally, remaining surfaces and sixth sternum glabrous. *Legs*. Trochanters nonmetallic shiny brownish black, glabrous; femora metallic copper-green, distally purple; tibiae and tarsomeres purple. *Male genitalia*. Aedeagus short, stout, widest on apical third where it is most bulky; abruptly tapering to a truncated apex with a short straight beak on the right; parameres extending beyond middle; subapical flange small and located medially only in left lateral aspect.

*Distribution*. —(Fig. 44). Northeast India (West Bengal, Arunachal Pradesh).

*Localities*. —INDIA: West Bengal: Darjeeling (BMNH); Arunachal Pradesh: Amatulla, 615 m, 23.V.61 (RLHC); Kameng Frontier Division, Bhairabkundi, 215 m, 20.V.61 (CMNH).

*Ecology*. —The habitat is unreported but the scarcity of this species in collections indicates a restricted habitat preference.

*Remarks*. —From our studies, *Cicindela parvimaculata* differs from *C. striolata* and *C. lineifrons* by several key characters, thereby substantiating the species distinction first recognized by Horn (1926).

### *Cicindela (Spilodia) lefroyi* Horn

*Cicindela lefroyi* Horn, 1908b:409.

*Type status*. Lectotype, female [here designated]. *Type labels*. "CHAPRA, BENGAL, MACKENZIE" [typeset folded label]; "Pusa Coll." [typeset]; "Andrewes, Lefroy" [first line typeset, second manuscript]; "Type!, Dr. W. Horn" [typeset]; "Syntypus" [typeset red label]; "DEI, EBERSWALDE" [typeset]; "LECTOTYPE, *Cicindela, lefroyi* W. Horn, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 15 mm; both front legs missing.] Paralectotype, a male [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository*. Lectotype and paralectotype at DEI. *Type locality*. "Pusa, Chapra" (Bihar, India).

*Cicindela lefroyi* Horn: Fowler, 1912:418, fig. 182.

*Lophyra (Spilodia) lefroyi* (Horn): Rivalier, 1961:131.

*Diagnosis*. —Distinguished by the brilliant copper-red head and pronotum; velvety black elytra with white maculae; glabrous trochanters, glabrous genae; penicillum on fourth male antennomere.

*Description*. —*General habitus*. Body medium to large (13.5–16 mm); head and pronotum bright copper-red dorsally, shiny blue-green laterally and in transverse sulci; elytra velvety black, standard pattern of white maculae; body shiny black ventrally. *Head*. Right mandible forked at apex on males, normal on females; labrum short, slightly raised medial carina, narrowly darkened only along anterior margin; six submarginal setae; female with five acute marginal teeth middle one largest; male with three minute, marginal teeth coequal in length; vertex, frons and genae glabrous; vertex with rugae forming moderately raised ridges arcuate near eyes, converging medially; frons with fine parallel rugae; fourth male antennomere with a penicillum of several small bristles. *Prothorax*. Pronotum with moderately coarse and irregular rugae; appressed setae scattered on disc, more abundant laterally and

along anterior margin; proepisterna copper-red, smooth on dorsal half, covered by dense white setae on ventral half; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a shallow groove; scutellum bright copper-red. *Elytra*. Surface granulate-punctate, noncontrasting punctures largest laterally and basally, becoming nearly impunctate on disc and apically; white maculae forming a standard but divided pattern; humeral lunule projecting straight mesad; medial portion of middle band, basal dot, apical lunule and sutural band each divided in two; epipleura shiny black; apex with small microserrulations; sutural spine small; apical margins separately rounded on each sex, more so on female. *Abdomen*. Dense white setae laterally on anterior five sterna on female, all six on male; remainder entirely glabrous. *Legs*. Trochanters nonmetallic reddish brown, glabrous; femora metallic copper-green, distal end purple; tibiae and tarsomeres purple-green. *Male genitalia*. Aedeagus short, stout, widest on apical third and very bulky on right side; tapering abruptly to a long, acute tip, displaced to the right; subapical flange small, evident only in left lateral aspect near apical orifice; parameres extending beyond middle.

*Distribution*.—(Fig. 43). India (Bihar, Punjab).

*Localities*.—INDIA: Union Territory: Chandigarh, 1.VII.1982, grassland (DLPC); Chandigarh, 25, 26.VII.1982, grassland (DLPC, CMNH).

*Ecology*.—Highly localized populations of this species occur in tall grassy areas. Adults are active for only a few weeks following the first substantial pre-monsoon rain.

### *Cicindela (Spilodia) vittigera* Dejean

*Cicindela vittigera* Dejean, 1825:107.

*Type status*. Syntype(s)? [unexamined; concept based on specimens! from Chandigarh, Union Territory, India, at DLPC]. *Type depository*. ?MNHNP. *Type locality*. "Indes Oriental."

*Cicindela vittigera* Dejean: Fowler, 1912:417, fig. 181.

*Lophyra (Spilodia) vittigera* (Dejean): Rivalier, 1961:131.

*Diagnosis*.—Distinguished by velvety green elytra; long and linear humeral lunule; glabrous trochanters; setose genae; male antennal penicillum present.

*Description*.—*General habitus*. Body medium (12–13 mm); head and pronotum dark copper or greenish copper; elytra dull velvety green, standard pattern of whitish yellow maculae; body shiny black ventrally. *Head*. Antennal scape with decumbent setae besides primary setae; labrum short lacking a medial carina; only anterior labral margin darkened, remainder of surface pale; three marginal labral teeth (larger on male than female); six submarginal labral setae; vertex moderately rugose, arcuate ridges near eyes, much finer concentric ridges medially; frons finely rugose, parallel ridges barely evident; frons and vertex glabrous; genae sparsely setose over most of posterior surface; fourth male antennomere with penicillum of multiple stiff bristles. *Prothorax*. Pronotum with a broad area of long, appressed setae laterally and anteriorly; proepisterna with dense appressed setae except on dorsal margin; surface dark blackish green with parallel wrinkles; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a small, deep elongate groove above middle along posterior margin; mesepisterna moderately setose ventrally. *Elytra*. Surface granulate-punctate, minute granules and shallow purple-black punctures contrasting with green color; maculae forming standard pattern; linear humeral lunule extending posteriorly to the middle of the disc; complete and broadly curved middle band; apical lunule on most specimens divided in two; basal dot linear; sutural band divided in two; epipleura shiny black basally, testaceous beyond middle; apex with small microserrulations; apical margins evenly rounded on each sex; sutural spine small, retracted at suture only slightly on male but extremely so on female. *Abdomen*. Sterna laterally with dense white setae on anterior five on female and six on male; remainder entirely glabrous. *Legs*. Trochanters nonmetallic reddish brown, glabrous; femora and tibiae metallic copper-green; tarsomeres purple-green. *Male genitalia*. Aedeagus short slender, widest at middle and slightly bulky on apical third; apex tapering abruptly to a short blunt tip, not displaced to the right; subapical flange small, short, located medially only in left lateral aspect; parameres extending beyond middle.

*Distribution*.—(Fig. 43). Pakistan (Punjab), northern India (Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal), Nepal and Bangladesh.

*Localities.*—INDIA: Union Territory: Chandigarh, 24.VII.1982, grassland (DLPC); Uttar Pradesh: Muzaffarnagar, 8.VII.1982, grassland (DLPC, CMNH). NEPAL: Dhading District: Ankhu Khola Valley from Ankhu Sangu to Sellentar, 530–750 m, cropland, stream bank shore, 26.VII.1983 (SMFM).

*Ecology.*—Adults occur in areas of tall grass usually in the upper portions of river flood plains.

### *Cicindela (Spilodia) multiguttata* Dejean

*Cicindela multiguttata* Dejean, 1825:109.

*Type status.* Syntype(s)? [unexamined; concept based on specimens! labelled “India, Punjab, 17 km N Rajpura, 15.VII.1982, grassland,” at DLPC]. *Type depository.* ?MNHN. *Type locality.* “Indes Oriental.”

*Lophyra (Spilodia) multiguttata* (Dejean): Rivalier, 1961:132.

*Lophyra (Spilodia) multiguttata* (Dejean): Naviaux, 1985:66, fig. 15, 42, 76.

*Diagnosis.*—Distinguished by greenish black elytra; short humeral lunule; glabrous trochanters; setose genae; fourth male antennomere lacking a penicillum.

*Description.*—*General habitus.* Body medium (12–13 mm); head and pronotum dorsally dark metallic copper, laterally green and blue, copper on some specimens; elytra greenish black, standard pattern of yellow maculae; body shiny purple-black to blue ventrally. *Head.* Antennal scape with several decumbent setae besides primary seta, remaining segments glabrous except for minute primary setae; labrum short; medial carina absent; mostly ivory except for narrow, darkened anterior and posterior margins; four to six submarginal setae; three small teeth medially along anterior margin; vertex rugose, highly raised arcuate ridges adjoining eyes, shallow rugae forming barely visible ridges medially extending onto frons; vertex and frons glabrous; genae with abundant decumbent setae. *Prothorax.* Pronotum subquadrate; surface with fine wavy rugae; anterior transverse sulci moderately impressed laterally, shallowly impressed medially; posterior transverse sulci moderately impressed throughout; pronotum covered by sparse, decumbent setae except medially on either side of center and on posterior reflexed margin; proepisterna dark purple, smooth and glabrous on dorsal quarter, thick white setae over remainder of surface; prosternum sparsely setose. *Pterothorax.* Female mesepisternal coupling sulcus a narrow groove slanting posteroventrally which disappears ventrally; mesepisterna with sparse, decumbent setae ventrally. *Elytra.* Surface granulate-punctate, minute granules and shallow purple-black punctures contrasting with green surface; maculae forming standard but fragmented pattern; humeral lunule complete; middle band constricted at its center; apical lunule on most specimens divided; basal dot present; sutural band divided in two; epipleura shiny black basally, testaceous beyond middle; apex microserrulate; sutural spine small; apical margins evenly and conjointly rounded on male, separately rounded on female. *Abdomen.* Female laterally with dense white setae on anterior five sterna, sparse on sixth; all male sterna laterally with dense white setae; medially sterna glabrous on both sexes. *Legs.* Trochanters nonmetallic reddish brown, glabrous; femora and tibiae metallic copper-green; tarsomeres purple-green. *Male genitalia.* Aedeagus short, bulky, widest at middle, of nearly uniform width in middle third; apex tapering broadly to a broad, blunt tip, displaced to the right; subapical flange long, located in both left (most conspicuous) and right lateral aspects flanking apical orifice; parameres extending beyond middle.

*Distribution.*—(Fig. 44). Northern India (Punjab, Haryana, Uttar Pradesh, West Bengal, Arunachal Pradesh, Assam), Nepal, Bhutan and Bangladesh.

*Localities.*—INDIA: Haryana: 10 km S Chandigarh, 26.VII.1982, grassland (DLPC); Punjab: 17 km N Rajpura, 15.VII.1982, grassland (DLPC, CMNH); Union Territory: Chandigarh, 29.VII.1982, grassland (DLPC); Uttar Pradesh: 20 km S Saharanpur, 28.VI.1983, grassland (DLPC, CMNH); Rishkesh, VII.1986 (KWC, CMNH); West Bengal: 15 km N Siliguri, 250 m, 3.VI.1985, grassy meadow (DLPC, CMNH); Arunachal Pradesh: Bomdi (Bomdila), 2710 m, 1.V.1961 (JSC). NEPAL: Hille, 1600 m, cultures, 3.VIII.1983 (Naviaux, 1985); Vallée de l'Arun, 29–31.VII.1983 (Naviaux, 1985); Nundhaki, 1000 m, V.1980 (Naviaux, 1985).

*Ecology.*—Adults frequent the moister grassy portions of river flood plains. Naviaux (1985) reported this species from the valleys and forests of eastern Nepal.

Subgenus *Cicindela* (*Lophyridia*) Jeannel

*Cicindela* (*Lophyridia*) Jeannel, 1946:151.

Type species.—*Cicindela dongalensis* Klug, 1832.

*Lophyridia* Jeannel: Rivalier, 1950:237.

*Nomenclatural note*.—Jeannel (1946) proposed this subgenus for a group of species from part of the Ethiopian biogeographic region. Rivalier (1950, 1958, 1961) expanded Jeannel's concept of the subgenus to include a number of medium to large species from the Palearctic, Ethiopian and Oriental biogeographic regions. Rivalier distinguished these species from other subgenera by what he considered a suite of quite constant and distinctive adult characters based on chaetotaxy, elytral maculae and flagellum shape. However, certain Oriental species adults, notably the Indonesian *Cicindela decemguttata* Fabricius, do not exhibit this suite of characters; rather, they have reduced labral chaetotaxy and body setae. Motschulsky (1862) made *C. decemguttata* Fabricius the type of his genus *Calomera*. While this name is clearly senior to Jeannel's, the two names appear to cover different concepts of species groupings and, therefore, are not synonyms.

*Diagnosis*.—*Cicindela* (*Lophyridia*) species adults differ from those of other subgenera as follows: 1) male genitalia moderately slender with an acute apex on males of many species; 2) male genitalic flagellum convoluted, associated sustained membranes raising auricular lobes on the right side in left lateral, and often, right lateral aspects, one lobe medially on the right especially evident; 3) body medium to large in length (10–16 mm); 4) labrum with more than ten submarginal setae arranged in irregular rows; 5) head has long, ventrally directed and semierect setae on the genae, and on adults of some species, areas of shorter, decumbent setae on the clypeus and frons; eyes are large and bulge outward from a broadly concave vertex; 6) pleural and sternal areas exhibit moderately abundant semierect setae; 7) head and pronotum surface sculpturing finely rugose to alutaceous; 8) adults of most species have a marginal elytral band (reduced to a small spot behind the middle on a few individuals) and three lunules fragmented on members of most species, but on members of some species nearly fused along the lateral margin, and on others reduced to small, widely separated spots; 9) anterior four femora on distal half with few to many setae along posterior margin bent back proximally at a right angle, for some adults, additional setae along remainder of the length are bent distally in the same manner.

*Included species*.—The following *Cicindela* (*Lophyridia*) species occur on the Indian subcontinent: *C. (L.) angulata* Fabricius, 1798 (= *sumatrensis* Herbst, 1806); *C. (L.) fowleri* Heynes-Wood and Dover, 1928, new rank; *C. (L.) plumigera* Horn, 1892, new rank (= *angulata* of authors, *nec* Fabricius, 1798); *C. (L.) cardoni* Fleutiaux, 1890; *C. (L.) chloris* Hope, 1831; *C. (L.) funerea* MacLeay, 1825; *C. (L.) fischeri elongatosignata* Horn, 1922; *C. (L.) littoralis conjunctaepustulata* Dokhtoureff, 1887; *C. (L.) aulica* Dejean, 1831; *C. (L.) quadripunctulata* Mandl, 1971.

Key to adults of *Cicindela* (*Lophyridia*) species

- |        |   |   |
|--------|---|---|
| 1.     | Clypeus setose .....  | 2 |
| –      | Clypeus glabrous .....  | 7 |
| 2.(1.) | Antennal scape with many erect setae besides subapical seta ..... |   |
|        | ..... <i>littoralis conjunctaepustulata</i> Dokhtoureff           |   |
| –      | Antennal scape with only one erect subapical seta .....           | 3 |

- 3.(2.) Frons with cluster of setae above antennal insertion ..... 4
  - Frons lacking cluster of setae above antennal insertion ..... 6
- 4.(3.) Humeral elytral lunule represented by two widely separated spots on most specimens (complete short lunule on a few others), not reaching middle of disc; middle band present but reduced to transverse portion and separate apical spot on disc ..... *fischeri elongatosignata* Horn
  - Humeral elytral lunule absent on most specimens (reduced to a small humeral dot on a few others); middle band represented only by marginal spot ..... 5
- 5.(4.) Apical elytral lunule incomplete, humeral dot absent for all specimens; frons setose toward middle; female elytra expanded laterally ..... *chloris* Hope
  - Apical elytral lunule complete, humeral dot absent for only a few specimens; frons glabrous toward middle; female elytra not expanded laterally ..... *funerea* MacLeay
- 6.(3.) Elytra with humeral maculae ..... *aulica* Dejean
  - Elytra lacking humeral maculae ..... *quadripunctulata* Mandl
- 7.(1.) Humeral elytral lunule complete although it may be short, long or connected to lateral expansion of middle band ..... 8
  - Humeral elytral lunule divided, each portion widely separated and not connected to lateral expansion of middle band ..... *fowleri* Heynes-Wood and Dover
- 8.(7.) Middle band of elytra with transverse portion concave anteriorly, terminal portion broadly connected ..... 9
  - Middle band of elytra with transverse portion not concave anteriorly, terminal portion separated or only narrowly connected ..... *cardoni* Fleutiaux
- 9.(8.) Lateral margins of female elytra expanded laterally; fourth male antennomere lacking a penicillum of stiff bristles ..... *angulata* Fabricius
  - Lateral margins of female elytra uniformly parallel; fourth male antennomere with a penicillum of stiff bristles .. *plumigera* Horn, new rank

### *Cicindela (Lophyridia) angulata* Fabricius

*Cicindela angulata* Fabricius, 1798:62.

*Type status.* Lectotype, male [here designated]. *Type labels.* “angula, ta” [handscript]; “Zool. Museum, DK Copenhagen” [typeset]; “LECTOTYPE, *Cicindela, angulata* Fabricius, by R.E. Acciavatti, '83” [typed and handprinted red label]. [Two additional syntypes at ZMUC mentioned by Zimsen (1964) are not there and must be considered lost (O. Martin, personal communication, 1983).] [Lectotype is 9 mm; antennae broken; both hind legs missing.] *Type depositary.* Lectotype at ZMUC. *Type locality.* “Tranquebar” (India).

*Cicindela sumatrensis* Herbst, 1806:179, pl. 172, fig. 1, new synonymy.

*Type status.* Lectotype, female [here designated]. *Type labels.* “177” [typeset]; “Sumatrensis, Hbst.\* Dej., ramosa Khorh. i.l., arcuata Kollar., Sumatr. Cicindr. Herbst.” [handscript on yellow label with black marginal line]; “Zool. Mus., Berlin” [typeset]; “LECTOTYPE, *Cicindela, sumatrensis* Herbst, by R.E. Acciavatti, '83” [typed and handprinted red label]. [Lectotype is 11.5 mm; pinned through left elytron; antennae broken; left hind femur missing.] Five other possible syntypes! at MNHB; only one of which bears the same locality and number “177” as the lectotype; this paralectotype, female [here designated] labelled “PARALECTOTYPE” [typed and handprinted red label]. *Type depositary.* Lectotype and paralectotype at MNHB. *Type locality.* “Sumatra” (Indonesia).

*Cicindela arcuata* Kollar, 1836:330.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depositary.* Unrecorded. *Type locality.* “India Orientali?”



*Cicindela leguilloui* Guérin-Méneville, 1841:120.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* Unrecorded. *Type locality.* "Borneo."

*Cicindela boyeri* Blanchard, 1853:4, pl. 1, fig. 2.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* Unrecorded. *Type locality.* Unspecified in original description.

*Cicindela renardi* Fleutiaux, 1890:169, new synonymy.

*Type status.* Holotype [by monotypy; unexamined; concept based on specimens! from West Bengal, India, at CMNH]. *Type depository.* ?MNHN. *Type locality.* "Asansol" (Bihar, India).

*Cicindela sumatrensis* Herbst: Fowler, 1912:371, fig. 162.

*Lophyridia sumatrensis* (Herbst): Rivalier, 1961:132.

*Lophyridia sumatrensis* (Herbst): Naviaux, 1984b:62, fig. 8–11.

*Nomenclatural note.*—Lectotype of *Cicindela angulata* Fabricius, 1798, is not conspecific with the species illustrated by Fowler (1912) which has been previously thought by most workers to be *Cicindela angulata* Fabricius; rather it is conspecific with *C. sumatrensis* Herbst, 1806. Schaum (1847, 1861) and Motschulsky (1855) mentioned that Dejean (1825) probably had misinterpreted the Fabrician name. Subsequent workers overlooked this error and interpreted *C. angulata* according to Dejean which is different from the species so named by Fabricius. The specific name *C. angulata* Fabricius, which has been used for these incorrect specific determinations, cannot be retained for the species to which the name was erroneously applied according to the Code (Article 49) (ICZN, 1985).

*Diagnosis.*—Distinguished by the standard pattern of elytral maculae; lunules extending onto disc; short, straight humeral lunule; long, broad sinuate middle band connected to lateral expansion; glabrous clypeus; long apical tooth on the mandible on both sexes; male antennae lack a penicillum.

*Description.*—*General habitus.* Body medium (10.5–14 mm); male body moderately slender, female body stouter; dorsum on most specimens bronze, on some specimens dark copper-brown, on others nearly black, on a few specimens blue-green; standard pattern of elytral maculae; female elytral margin greatly expanded laterally at middle; body ventrally copper, except for small, pale whitish lateral areas on fifth and sixth abdominal sterna on both sexes and at middle posteriorly on fifth abdominal sternum on female. *Head.* Antennal scape with one primary seta; mandibles with apical tooth long, exceeding one-third of entire mandible length in male and exceeding half of entire length in female; labrum short, flattened, ivory; 12 to 16 submarginal setae in several rows; one medial tooth on female labrum, tooth small and inconspicuous on male labrum; frons and vertex glabrous, surface finely textured, shallow rugae near small eyes; genae covered by long, appressed setae. *Prothorax.* Pronotum subquadrate, anterior and posterior transverse sulci shallowly impressed, surface finely textured, only shallow irregular rugae and midline evident; pronotum laterally with long, abundant setae originating from several irregular rows of setigerous punctures and extending medially toward disc, dorsally glabrous, proepisterna entirely covered by long, dense, appressed and erect setae; prosternum with large patch of long, erect setae medially from anterior margin to between front coxae. *Pterothorax.* Female mesepisternal coupling sulcus a posteroventrally slanting groove deepest at ventral end; mesepimera, mesepisterna and lateral halves of metepisterna covered by long, dense, appressed setae. *Elytra.* Shallow blue-green punctures throughout, minutely granulate-punctate basally on disc, nearly impunctate apically; maculae complete and quite constant in size and shape; middle band sinuate medially, expanded along margin laterally and narrowly connected to humeral lunule but on most specimens separated at lateral margin from complete apical lunule; elytral apices uniformly rounded on each sex; sutural spine moderately large; microsculptulations large. *Abdomen.* Laterally with dense appressed setae on all sterna on male, only anterior five sterna on female. *Legs.* Trochanters dark slightly metallic, one subapical seta on each front and middle segment; femora metallic copper, tinged with green and with numerous long, erect setae along posterior margin all of which are straight except for a few hooked ones distally; tibiae and tarsomeres metallic copper and green. *Male genitalia.* Aedeagus moderately slender with a blunt apex; small broad tip raising membranes on the left at the distal end of apical orifice; subapical flange small, symmetrical in each lateral aspect flanking apical orifice.



**Geographic variation.**—The name *Cicindela renardi* refers to a blue-green color morph occasionally present in populations from northeastern India (West Bengal, Assam) and Nepal; therefore, we synonymize it with the nominal *C. angulata*.

**Distribution.**—(Fig. 45). Generally distributed throughout the Indian subcontinent eastward into Southeast Asia.

**Localities.**—INDIA: Haryana: 10 km N Chandigarh, 16.VII.1982, river sand bar (DLPC); Uttar Pradesh: Muzaffarnagar, 11.VII.1982, river sand bar (DLPC); 35 km SW Dehra Dun, 30.VI.1983, rocky creek bed (DLPC); Karnataka: Mysore, 13.VI.1983, sandy river beach (DLPC); 30 km S Kanakapura, 1.VI.1984, sandy river bank (DLPC); 30 km S Kanakapura, 15.VIII.1985, sandy river edge (DLPC); Karwar, sea level, 12.VI.1987, ocean beach (DLPC); Mangalore, 5.VI.1984, inner bay beach (DLPC); 22 km W Kunigal, 18.XI.1985 (DLPC); Punjab: 17 km N Rajpura, 27.VII.1982, river sand bar (DLPC); Kerala: Cochin, 21.VI.1983, inner bay beach (DLPC); Walayar Forest, 215 m, IX.1976 (CMNH); Tamil Nadu: 60 km N Madurai, 18.V.1984, sandy river beach (DLPC); Kurumbagaram, IX.1955 (CMNH); Kurumbagaram, 21.XII.1946 (CMNH); Madurai, 14.XI.1985 (DLPC); 16 km S Karur, 6.XI.1985 (DLPC); 10 km E Musiri, 25.VII.1986, sandy river edge (DLPC); Goa: Fort Aguada, 23.V.1984, inner bay beach (DLPC); Gujarat: Sasan-Gir, 27.V.1984, sandy river bank (DLPC); Union Territory: 7 km S Pondicherry, 22.I.1985 (DLPC); Karikal, VII.1971 (CMNH); Mahe at Cannanore, 29.X.1985 (DLPC); West Bengal: 25 km N Siliguri, 2.VI.1985, gravel river bank (DLPC); Assam: Margherita, IV.V.1889 (UMDE); Vangai Chungpao, 155 m, 21.V.1960 (JSC); Bihar: 90 km W Ranchi, 23.VI.1986, sandy river edge (DLPC); Araku, 900 m, 29.VI.1986, sandy river edge (DLPC); Andhra Pradesh: Vijayawada, 16.VII.1985, sandy river edge (DLPC); 40 km SW Warangal, 415 m, 14.VIII.1985, sandy river edge (DLPC). NEPAL: 51 km W Kathmandu, 26.V.1986, sandy river edge (DLPC); Sauraha, Chitwan Royal Park, 28.V.1986, sandy river edge (DLPC); Bhadrapur, 120 m, 12.V.1984 (RNC, CMNH); Gajuritar, 520 m, 20.V.1984 (RNC, CMNH); Chitwan District: Rapti River at Merghauli, II.1973 (CMNH); Lothar River at Chitwan Road, IX.1971 (CMNH).

**Ecology.**—Adults are found in moist, sandy river banks and sandy margins of inner ocean bays. Naviaux (1984b) found this species along the edges of reservoirs and stagnant ponds.

### *Cicindela (Lophyridia) fowleri* Heynes-Wood and Dover, new rank

*Cicindela sumatrensis imperfecta* Horn, 1894a:173 (preoccupied, LeConte, 1851:171).

**Type status.** Lectotype, female [here designated]. **Type labels.** “Canara” [typeset]; “Co-, type” [typeset circular label with green border]; “LECTOTYPE, *Cicindela, sumatrensis imperfecta*, W. Horn by R.E. Acciavatti, '83” [typed and handprinted red label]. [Lectotype is 10.5 mm; right hind leg missing; antennae broken.] Paralectotypes, one each sex! at IRSNB, each [here designated] labelled “PARA-LECTOTYPE” [typed and handprinted red label]. **Type depositary.** Lectotype at BMNH; two paralectotypes at IRSNB. **Type locality.** “North Kanara” (Karnataka, India).

*Cicindela fowleri* Heynes-Wood and Dover, 1928:118 (replacement name).

*Cicindela sumatrensis imperfectula* Horn, 1938:42, new synonymy.

**Nomenclatural note.**—The synonymy of Horn's replacement name was first pointed out by Schilder (1953); however, he did not elevate *Cicindela fowleri* to a full species.

**Diagnosis.**—Distinguished by the standard but fragmented pattern of elytral maculae consisting of lunules narrowed and separated into spots; both sexes have a short apical tooth on the mandible.

**Description.**—**General habitus.** Body medium (10.5–12 mm); male body moderately slender with subparallel elytra, female body stouter; moderate elytral expansion near middle along lateral edge; head and pronotum dark bronze to brown dorsally with copper-green reflections; elytra copper with maculae consisting of lunules narrowed and separated into spots; body ventrally copper except for small, pale whitish lateral areas on fifth and sixth abdominal sterna on both sexes and at middle posteriorly on fifth abdominal sternum on female. **Head.** Similar to *Cicindela angulata* in color, structure and setal pattern, except apical tooth of mandible less than one-third the total mandible length. **Prothorax.** Pronotum subquadrate, anterior and posterior transverse sulci shallowly impressed, surface finely textured, shallow irregular rugae and midline evident; pronotum dorsally glabrous,

laterally long, abundant setae originating from several irregular rows of setigerous punctures extend medially toward disc; proepisterna covered by long, dense, appressed and erect setae; prosternum with large patch of long, erect setae medially from anterior margin to between front coxae. *Pterothorax*. Female mesepisternal coupling sulcus a posteroventrally slanting groove, deepest at ventral end. *Elytra*. Surface with large purple punctures surrounded by blue-green color especially apically, impunctate laterally and apically but granulate on disc; maculae forming standard pattern but lunules narrowed and separated into spots so that only the ends of each lunule are present; female elytra moderately expanded at lateral margin; microsculptures small; apices uniformly rounded; sutural spine small. *Abdomen*. All sterna laterally with dense appressed setae. *Legs*. Trochanters dark slightly metallic, one subapical seta on each front and middle segment; femora metallic copper tinged with green; numerous long, straight erect setae along posterior margin except for a few hooked ones distally; tibiae and tarsomeres metallic copper and green. *Male genitalia*. Aedeagus moderately slender with a blunt apex; small broad tip raising membranes on the left at the distal end of a long apical orifice; subapical flange small, symmetrical in each lateral aspect flanking the apical orifice.

*Distribution*. — (Fig. 45). Occurs inland at the western base of the Western Ghats in India (Kerala, Karnataka, Goa, Maharashtra, Gujarat). Additional populations occur in the north Deccan highlands of India (Madhya Pradesh) and east to the Chota Nagpur highlands of Bihar, India.

*Localities*. — INDIA: Tamil Nadu: 25 km W Coimbatore, sandy river beach (DLPC); Nilgiri Hills, Devala, 985 m, IX.1984 (CMNH); Kerala: Walayar Forest, 215 m, IX.1976 (CMNH); Walayar Forest, 18.X.1985, sandy river edge (DLPC); 25 km E Chalakudi, 20.V.1985, sandy river beach (DLPC); 15 km E Palghat, 19.V.1985, sandy river beach (DLPC); Karnataka: 60 km W Dharwar, 27.V.1985, sandy river beach (DLPC); 40 km E Mudigere, 9.VI.1985, sandy river beach (DLPC); Shimoga, V.1897 (CMNH); Sringeri, 650 m, 8.VI.1987, sandy river bank (DLPC); Jog Falls, 550 m, 10.VI.1987, forest stream edge (DLPC); 50 km E Jog Falls, 650 m, 10.VI.1987, grassland (DLPC).

*Ecology*. — Adults are found in moist habitats bordering rivers.

*Remarks*. — Although *Cicindela (Lophyridia) fowleri* and *C. (Lophyridia) angulata* adults have a very similar female coupling sulcus and male genitalia, there are major differences in habitat preference and mandible length permitting different prey size selection. Both of these factors would allow these species to exploit different niches where they might occur syntopically; however, adults of both species appear to have minimal contact. *Cicindela fowleri* adults appear to be restricted to moist habitats bordering forested rivers between 300 and 1000 m, whereas *C. angulata* adults frequent more open sandy, riparian habitats and ocean bays. *Cicindela angulata* individuals occasionally are found among populations of *C. fowleri* in Kerala, and where they syntopically occur, evidence of intergradation is lacking. Besides the reduced elytral maculation of *Cicindela fowleri* adults, members of these two species differ in the relative size of their mandibular teeth; *C. angulata* adults have an apical tooth exceeding one-third of the total mandible length whereas *C. fowleri* adults have an apical tooth less than one-third of the total mandible length.

### *Cicindela (Lophyridia) plumigera* Horn, new rank

*Cicindela angulata* Dejean, 1825:89 (preoccupied, Fabricius, 1798:62).

*Type status*. Syntype(s)? [unexamined; our concept of this species name is based on its description]. *Type depository*. ?MNHN. *Type locality*. "Indes orientales."

*Cicindela latipennis* Parry, 1844:454 (preoccupied, Castelnau, 1835:139).

*Type status*. Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository*. Unknown [not at BMNH (G. G. Kibby, personal communication, 1984); apparently lost]. *Type locality*. "Assam" (India).

*Cicindela plumigera* Horn, 1892a:86, new rank.

*Type status.* Lectotype, male [here designated]. *Type labels.* "Trichinopoly, P. Castets, 1888" [hand-script on rectangular label with black border]; "D.W. Horn." [same format as previous label]; "PARATYPUS" [typeset on pink label]; "Museo Civico, di Genova" [typeset]; "LECTOTYPE, *Cicindela plumigera* W. Horn, by R.E. Acciavatti, '83" [typed and hand printed red label]. [Lectotype is 11.5 mm.] *Type depository.* Lectotype at MCSNG. *Type locality.* "Trichinopolis, Suden von Vorder Indien" (Tiruchchirappalli, Tamil Nadu, India).

*Cicindela angulata* Fabricius: Fowler, 1912:370, fig. 161.

*Lophyridia angulata* (Fabricius): Rivalier, 1961:132.

*Lophyridia angulata* (Fabricius): Naviaux, 1985:62, fig. 9, 40, 73.

*Nomenclatural note.*—This species has erroneously been referred to as *Cicindela angulata* Fabricius. Since the previously held concept of *C. angulata* Fabricius is invalid (refer to discussion under *C. angulata* Fabricius), *C. plumigera* Horn, the next available valid name, must be used for this species. However, the nominate subspecies of *C. plumigera* refers to the small, copper-brown individuals in southern India. Although the larger, dark brown to olive green individuals found in northern India and adjoining countries of Southeast Asia are adequately described and illustrated by many authors under *C. angulata* Fabricius, in actuality they represent an unnamed subspecies which we describe below.

*Cicindela saxatilis* Gistel (1837:49) has been referred to this species but is herein treated as a *nomen dubium*. No type exists, and quite possibly never did, according to Scherer's (1982) published information about Gistel's collection and types in general, and specific information about the type status of *saxatilis* in particular (Scherer, personal communication, 1986). When Gistel described his species, he regarded it as identical to the concept of *C. angulata* held by Dejean (1825); in fact, he simply copied Dejean's brief Latin description. However, Dejean's concept of *C. angulata* was different from that held by Fabricius (1798) (refer to synonymy under *C. angulata* Fabricius). To compound the confusion, in the same publication, Gistel (1837) recognized another species under the name *C. angulata* Fabricius and considered that *C. saxatilis* might be a synonym of it, apparently in the same sense that Fabricius held this species. Thus, from Gistel's (1837) vague description of *C. saxatilis*, his uncertainty about its relation to previously described species, and in the absence of a type specimen, the taxonomic position of *Cicindela saxatilis* must remain uncertain and should be treated as a *nomen dubium* to further stabilize the nomenclature of this species.

The following published name has been associated with this species: *designata* Dejean, 1821:1; however, because it was neither described nor figured, Dejean's name is unavailable.

*Diagnosis.*—Distinguished by the standard pattern of elytral maculae; lunules long, complete, extending onto disc and separated at lateral margin on most specimens (connected laterally on a few specimens); humeral lunule hooked at apical end, middle band sinuate; glabrous clypeus; small, pale whitish lateral areas on fifth and sixth abdominal sterna.

*Description.*—*General habitus.* Body medium to large (12.5–16 mm); head and pronotum bronze with copper-green reflections; elytra dark brown to olive green on most specimens, copper on some specimens; standard pattern of elytral maculae varied; on most specimens lunules complete, middle band sinuate; on a few specimens all lunules joined at margin; body metallic copper or green ventrally except for small pale whitish lateral areas on fifth and sixth abdominal sterna. *Head.* Labrum short, ivory, one medial tooth; 12 to 18 submarginal setae arranged in several irregular rows; fourth male antennomere with large penicillum of stiff bristles; head glabrous except genae covered by long, ventrally

directed setae. *Prothorax*. Pronotum smooth and alutaceous; long, appressed setae laterally originating from several irregular rows of large setigerous punctures; proepisterna entirely obscured by long, dorsally directed, appressed setae; prosternum with long setae between coxae, remainder glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a narrow, slightly sinuate and slanting groove medially; mesepisterna on dorsal half covered by setae. *Elytra*. Surface granulate-punctate; large shallow blue-green to purple punctures throughout; granules minute on copper specimens, but large and occupying most of interpunctural area, on dark brown or olive specimens; lunules varied in both size and shape although all are large and separate with lateral expansion of middle band along elytral margin on most specimens (on a few specimens all lunules narrowly connected along lateral margin); humeral lunule complete and large, extending obliquely onto disc with enlarged apical end curving slightly forward; middle band sinuate on disc, lateral expansion merging with humeral lunule; apical lunule complete, anterior end enlarged and projecting slightly forward; apex with large microserrations; sutural spine large; apical margin slightly more truncated from outer apical angle to suture on female than on male. *Abdomen*. Dense appressed setae laterally on all sterna extending nearly to middle where surface glabrous or with a few fine hairs. *Legs*. Trochanters varied in color, front and middle pairs reddish testaceous, rear pair shiny black; one subapical seta on each front and middle trochanteral segment; femora and tibiae metallic copper-green and red; tarsomeres purple. *Male genitalia*. Aedeagus moderately broad, bulky and widest in apical third; apex broad, blunt, small broad tip raising membranes in the left at the distal end of a long apical orifice; subapical flange small, abruptly raised and located medially in either lateral aspect flanking apical orifice midway along its length.

*Geographic variation*.—Throughout the range of this species, adults exhibit considerable variation in body size, dorsal color and elytral maculae. We treat only those subspecies known to occur on the Indian subcontinent. Populations in southern India representing the nominal subspecies *Cicindela plumigera plumigera* have more copper elytra with narrower maculae, especially the middle band, and are smaller in body size than populations in northern India and Nepal; the latter represent a new subspecies described herein.

*Cicindela (Lophyridia) plumigera macrograptina*, new subspecies

*Description*.—Similar to the nominal form in all morphological characters except body size larger, body color dark brown to olive green and elytral maculae broader and bolder in contrast with background.

*Type specimens*.—Holotype, male, labelled "INDIA, Uttar Pradesh, Bijnor, 11.VII.1982, D.L. Pearson" (typeset); "river sand bar" (typeset); "HOLOTYPE, Cicindela, plumigera, macrograptina, Acciavatti & Pearson" (typed and hand-printed red label). Allotype female and 27 paratypes with the same label data as the holotype; 8 paratypes from the type locality but collected 8.VII.1982.

*Type depositary*.—Holotype and allotype at NMNH; 5 paratypes at CMNH; 30 paratypes at DLPC.

*Type locality*.—Bijnor, Uttar Pradesh, India.

*Etymology*.—This name is feminine singular and derived from the Greek *macro* (large), *grapto* (inscribed), and *-ina* (likeness) with respect to its large body size and bold elytral maculae resembling handwritten script.

*Distribution*.—(Fig. 45). *Cicindela plumigera plumigera* occurs in southern India (Tamil Nadu, Karnataka), whereas *C. plumigera macrograptina* occurs in Pakistan (Punjab), northern India (Punjab, Uttar Pradesh, Haryana, Orissa, Bihar, West Bengal, Assam), Nepal and Bangladesh.

*Localities*.—*Cicindela plumigera plumigera*. INDIA: Karnataka: 40 km E Mudigere, 950 m, 9.VI.1985, sandy river beach (CMNH); Bangalore, 916 m, VI.1984 (DLPC); 30 km S Kanakapura, 3.VI.1985, sandy river beach (DLPC); Sangam, 1.V.1984, sandy river beach (DLPC); Sringeri, 650 m, 8.VI.1987, sandy river bank (DLPC); Union Territory: Pondicherry (CMNH). *Cicindela plumigera macrograptina*. INDIA: West Bengal: 25 km N Siliguri, 2.VI.1985, gravel river beach (DLPC); Haryana: 10 km S Chandigarh, 15.VII.1982, river sand bar (DLPC); Uttar Pradesh: Bijnor, 11.VII.1982, river sand bar

(DLPC); Assam: Gauhati, 55 m, 27.IV.1985 (DLPC); Kaziranya, Kohora, 80 m, 2.V.1985 (DLPC); 25 km S Dibrugarh, 1.V.1985 (DLPC). NEPAL: Lothar (River) near Birganj, 140 m, 1, 9.IX.1967 (CNCO); Chitwan District: Lothar River at Chitwan Road, IX, 1971 (CMNH). BANGLADESH: Dinajpur District: Dinajpur, XI.1963 (CMNH).

*Ecology.*—Adults only occur along wet sandy and gravelly banks of large rivers. Fowler (1912) reported their attraction to lights.

***Cicindela (Lophyridia) cardoni* Fleutiaux**

*Cicindela cardoni* Fleutiaux, 1890:169.

*Type status.* Lectotype, male [here designated]. *Type labels.* "Coll. R.I.Sc. N.B., Inde, Kunbir, Nowatoli" [typeset and manuscript on yellow]; "E. Fleutiaux det. 1890, *Cicindela*, *C. cardoni* Fleut." [first two lines typed, third handwritten], "Type" [handscript], "Syntype" [red typeset letters], "LECTOTYPE, *Cicindela*, *cardoni* Fleutiaux, by R.E. Acciavatti, '83" [typed and hand printed red label]. [Lectotype is 12 mm; right front leg missing.] Paralectotypes! (three males and one female) at IRSNB each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depositary.* Lectotype and four paralectotypes at IRSNB. *Type locality.* "Asansol and Kunbir Nowatoli" (West Bengal, India).

*Cicindela cardoni* Fleutiaux: Fowler, 1912:372, fig. 163.

*Lophyridia cardoni* (Fleutiaux): Rivalier, 1961:132.

*Lophyridia cardoni* (Fleutiaux): Naviaux, 1984b:63, fig. 12–14.

*Diagnosis.*—Distinguished by the standard pattern of elytral maculae extending partially onto disc; humeral lunule short, middle band divided or portions narrowly connected; glabrous clypeus.

*Description.*—*General habitus.* Body medium (12–13.5 mm); upper surface dark brown or blackish brown; elytral maculae forming standard but fragmented pattern; humeral lunule not extending onto disc; body metallic copper-red ventrally except for small, pale whitish lateral areas on fifth and sixth abdominal sterna on both sexes. *Head.* Labrum short, ivory, single medial tooth; 12 to 16 submarginal setae; vertex finely rugose, slightly raised parallel ridges at base of eyes, ridges inconspicuous next to eyes, also medially and on frons; vertex and frons glabrous; genae covered by long, ventrally directed setae. *Prothorax.* Pronotal surface finely rugose, disc glabrous; lateral margin with sparse, long, appressed setae originating from large setigerous punctures arranged in several irregular rows at edge; proepisterna covered by long, dorsally directed setae; prosternum covered by long, appressed setae. *Pterothorax.* Female mesepisternal coupling sulcus a shallow medial groove. *Elytra.* Surface granulate-punctate; shallow purple punctures and small granules throughout; elytral base and suture often bright copper-green; maculae forming a standard pattern; apical end of humeral lunule laterally situated, not extending onto disc; expanded lateral portion of middle band joining humeral lunule on most specimens (separated on a few specimens) but separated from apical lunule; medial portion of middle band divided to form a separate spot on most specimens (on some specimens joined by a narrow line); apex with large microserrulations; sutural spine small; apical margins rounded on each sex. *Abdomen.* Sterna covered by appressed setae laterally, glabrous medially. *Legs.* Trochanters shiny black, one subapical seta on each front and middle segment; femora and tibiae metallic copper-green and red; tarsomeres purple. *Male genitalia.* Aedeagus moderately broad, bulky and widest on apical third; apex broad, blunt, small broad tip raising membranes on the left at the distal end of a long apical orifice; subapical flange small, abrupt and located medially in both lateral aspects midway along apical orifice length.

*Geographic variation.*—Specimens from Gujarat are uniformly blackish brown with pattern of elytral maculae more greatly reduced and separated compared to specimens from elsewhere in India.

*Distribution.*—(Fig. 46). India (Gujarat, Rajasthan, Maharashtra, Karnataka, Kerala, Tamil Nadu, Orissa, Bihar, West Bengal, Sikkim) and Sri Lanka.

*Localities.*—INDIA: Karnataka: 15 km SE Badami, 19.VI.1984, sandy river beach (CMNH); 35 km NE Bantyal, 5.VI.1984, sandy river beach (DLPC); Belthangady, 100 m, 20.XI.1984 (DLPC); 30 km S Kanakapura, 16.VI.1985, sandy river beach (DLPC); 30 km S Kanakapura, 15.VIII.1985, sandy river edge (CMNH); 60 km NE Mangalore, 30.V.1985 (DLPC); Gujarat: Sasan-Gir, 27.V.1984, sandy

river beach (DLPC); 18 km SE Pavagarth, 10.X.1984 (DLPC); Tamil Nadu: 16 km S Karur, 6.XI.1984 (CMNH); 7 km S Chingleput at Palar River, 21.I.1985 (DLPC); 10 km E Musiri, 25.VII.1986, sandy river edge (DLPC); Rajasthan: Abu Road, Banas River, 30.IX.1984 (DLPC); Kerala: 10 km E Nilambur, 30.X.1984 (DLPC); Tarmalai, 27.V.1986, sandy river edge (DLPC); Bihar: 40 km S Palamau, 22.VI.1986, sandy river edge (DLPC); 90 km W Ranchi, 23.VI.1986, sandy river edge (DLPC). SRI LANKA: Kurunegala, 11.VI.1983 (RNC, CMNH); Mahaweli Ganga, East Polonnarawa, 28.IV.1981 (RNC, CMNH).

*Ecology.*—Adults frequent wet sandy banks of small to large rivers. Naviaux (1984b) found this species sometimes occurring with *Cicindela angulata* but less abundant. Ganeshaiah and Belavadi (1986) presented detailed ecological observations about this species.

### *Cicindela (Lophyridia) chloris* Hope

*Cicindela chloris* Hope, 1831:21.

*Type status.* Lectotype, female [here designated]. *Type labels.* "Syn, type" [typeset circular label with blue border]; "Type" [typeset circular label with red border]; "Nepal" and "3924.b" [handscript on both sides of circular label]; "Cicindela chloris type Hope" [handscript]; "Hope's det. label is stuck into the 8# Mus. Cat. of the Collection, C.M.F. von Hayek det. 1972" [handscript and typeset]; "LECTOTYPE, Cicindela, chloris Hope, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 12 mm; right antenna and hind leg missing.] *Type depository.* Lectotype at BMNH. *Type locality.* "Nepal."

*Cicindela himaleyica* Redtenbacher, 1848:497, pl. 23, fig. 1.

*Type status.* Lectotype, female [here designated]. *Type labels.* "227" [typeset]; "Himalayica, Redt.\*, Himalaya. Kollar" [handscript on yellow label with black marginal line]; "Zool. Mus., Berlin" [typeset]; "LECTOTYPE, Cicindela, himaleyica Redtenbacher, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 12.5 mm; hole in the left elytron at middle edge; right antenna missing.] [A possible syntype! at MNHB, differently labelled from the lectotype, should not be considered syntypic.] *Type depository.* Lectotype at MNHB. *Type locality.* "Caschmir" (Kashmir, India).

*Cicindela chloris* Hope: Fowler, 1912:376, fig. 165.

*Lophyridia chloris* (Hope): Rivalier, 1961:132.

*Cicindela chloris lobbichleri* Mandl, 1963:114.

*Type status.* Holotype, male! and paratype, female! [glued onto paper]. *Type labels.* "N.W. Karakorum, Gilgit, 25.V.1959, F. Lobbichler" [typeset and handprinted]; "Cicindela, chloris Hope, det. Dr. Ing. K. Mandl 1961" [typeset and handprinted]; "Holo-, Type-Cicindela, chloris ssp., Lobbichler m., Ing. K. Mandl 1961" [typeset and handprinted orange on top of white label]; "Cicindela (Lophyridia), chloris Hope, det. R.E. Acciavatti, 1987" [typeset and handprinted]. *Type depository.* Holotype and paratype at ZSBS. *Type locality.* "Gilgit, N.W. Karakorum" (Jammu and Kashmir), India.

*Lophyridia chloris* (Hope): Naviaux, 1985:62, fig. 8, 39, 72.

*Nomenclatural note.*—A male! of *Cicindela chloris* at HMO, previously considered syntypic, is not conspecific with that species, but represents a green form of *C. funerea assimilis* Hope. G. G. Kibby, BMNH (personal communication, 1983), researched this situation with the following results. Apparently, Hope had received from Hardwicke a mixed series of these two species for identification. Hope based his descriptions primarily on body color. When Hope's collection was later divided between HMO and BMNH, the syntypes were simply assigned to each museum without knowledge of this mixed series. Our selection of the appropriate syntype as lectotype is based upon Hope's description of *C. chloris* which clearly pertains to the BMNH specimen with its elytral surface densely punctured; the HMO syntype fits *C. funerea assimilis* Hope with its elytral surface granulate and lacking distinct punctures.

*Diagnosis.*—Distinguished by setose clypeus; setal patch on frons above anten-



nal insertion; lateral elytral maculae not extending onto disc, humeral dot absent, apical lunule complete; elytral surface granulate-punctate.

*Description.*—*General habitus.* Body medium (11.5–12 mm); dorsal color varied, bright green, copper-green or black-green to deep blue-green and blue; three marginal elytral spots on apical half; body metallic blue-green ventrally. *Head.* Antennal scape glabrous except for subapical primary seta; labrum short, ivory with one long tooth at middle on both sexes, 12 to 16 submarginal setae; clypeus and frons covered by long semierect setae; vertex moderately rugose with shallow raised parallel ridges at base of eyes, becoming inconspicuous next to eyes and medially; genae covered by long, ventrally directed setae. *Prothorax.* Pronotal surface smooth, alutaceous and glabrous dorsally; lateral and anterolateral margins covered with long, semierect setae originating from large setigerous punctures; anterior and posterior transverse sulci shallowly impressed laterally, not impressed at center; anterior reflexed margin wide at middle; proepisterna covered by dense, dorsally directed, long setae; prosternum with long setae. *Pterothorax.* Female mesepisternal coupling sulcus a thin groove slanting posteroventrally, shallowest dorsally, deepest at lower posterior end. *Elytra.* Female elytra with a lateral expansion; elytral surface granulate-punctate, dull; varied in color from black and black-parallel ridges to blue-green and blue; three marginal spots behind middle, the first two on most specimens joined with thin line, the third often with short, marginal extension not reaching suture; large microsculptulations at apex; small sutural spine; apical margin truncated from outer apical angle to suture, cojointly rounded at suture. *Abdomen.* Sterna laterally covered with dense, appressed setae except for sixth sternum on female, medially all sterna glabrous. *Legs.* Trochanters shiny black, slightly metallic, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic green. *Male genitalia.* Aedeagus long and slender, widest at middle and slightly bulky on right beyond middle; gradually tapering to a large rounded tip in left lateral aspect, sclerotized on the right side and membranous on the left; subapical flange short and abrupt, medially situated, symmetrical in both left and right lateral aspects near apex; apical orifice long, extending for nearly half entire length of aedeagus.

*Geographic variation.*—Dorsal color within a population is varied, specimens being bright green, copper-green, black-green or dark blue. The name *C. chloris lobbichleri* refers to the dark blue individuals occurring in extreme northwest Jammu and Kashmir, India. This dorsal color also appears on specimens available to us for study from other localities in Nepal as well as Uttar Pradesh, India. On this basis, we agree with Naviaux (1985) that *C. chloris lobbichleri* represents only an aberration and his placement of this name in synonymy is inferred.

*Distribution.*—(Fig. 46). Found across northern India (Arunachal Pradesh, Assam, West Bengal, Sikkim, Bihar, Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Jammu and Kashmir), Bhutan, Nepal and Pakistan (Northwest Frontier, Punjab).

*Localities.*—INDIA: Haryana: 10 km N Chandigarh, 16.VII.1982, rocky river side (DLPC); Uttar Pradesh: Hardwar, 10.VII.1982, rocky river side (DLPC); 35 km SW Dehra Dun, 30.VI.1983, rocky creek bed (DLPC); 20 km N Dehra Dun, 9.VII.1982, rocky creek bed (DLPC); 20 km NE Saharanpur, 28.VI.1983, sandy river beach (DLPC); Saharanpur, 9.VII.1982, river sand bar (DLPC); Jammu and Kashmir: Bandipur, 25.VI.1982, rocky river side (DLPC); Himachal Pradesh: 10 km S Solon, 18.VII.1982, rocky river side (DLPC); 10 km N Kiratpur, 25.VII.1982, rocky creek bed (DLPC); West Bengal: 15 km N Siliguri, 3.VI.1985, sandy river beach (DLPC). NEPAL: Sauraha, Royal Chitwan National Park, 28.V.1986, sandy river edge (DLPC); Royal Chitwan National Park, 21.XI.1980 (DLPC); 51 km W Kathmandu, 26.V.1986, sandy river edge (DLPC).

*Ecology.*—Adults occupy wet sandy and gravelly areas on river edges. In West Bengal, *Cicindela (Lophyridia) chloris* and *C. (Lophyridia) funerea* occur at the same localities but separate by microhabitats; *C. chloris* is found on open river edges away from forests whereas *C. funerea* is generally on river edges near or within forests.

*Remarks.*—*Cicindela chloris* superficially resembles *C. funerea assimilis*; however, on adults of the former species the elytral surface is distinctly granulate-punctate rather than solely granulate with shallow impunctate depressions as on *Cicindela funerea*.

*Cicindela (Lophyridia) funerea* MacLeay*Cicindela funerea* MacLeay, 1825:12.

*Type status.* Lectotype, male [here designated]. *Type labels.* "Type" [typeset circular label with red margin]; "Java, (Horsfield)" [typeset divided by an orange line]; "60-15, E.L.C." [typeset]; "Funerea. Mac." [typeset italics], "LECTOTYPE, *Cicindela, funerea* MacLeay, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 11 mm; pinned through left elytron; elytra copper-brown.] *Type depository.* Lectotype at BMNH. *Type locality.* "Java" (Indonesia).

*Cicindela marginepunctata* Dejean, 1826:428.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* ?MNHN. *Type locality.* "Cochinchine."

*Cicindela assimilis* Hope, 1831:21.

*Type status.* Lectotype, female [here designated]. *Type labels.* "Syn-, type" [typeset circular label with blue edge]; "Type" [typeset circular label]; "(Type) Hope" [handscript, first word underlined]; "Hope's det. label is stuck into the 8# Mus. Cab. of the Collection, C.M.F. von Hayek det. 1972" [handscript and typeset]; "LECTOTYPE, *Cicindela, assimilis* Hope, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 14 mm; hole through right elytron where previously pinned; body greenish black.] [Selection of the female syntype of *Cicindela assimilis* as lectotype is consistent with lectotype selection for *C. chloris* because the female mesepisternal coupling sulcus and lateral elytral expansion are the most diagnostic characters for separating these two species where their green color morphs are sympatric.] Paralectotypes, two males! at BMNH, one greenish black and the other green, each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository.* Lectotype BMNH; two paralectotypes HMO. *Type locality.* "Nepal."

*Lophyridia funerea* (MacLeay): Rivalier, 1961:132.*Lophyridia funerea* (MacLeay): Naviaux, 1985:60, fig. 7, 38, 71.

*Diagnosis.*—Distinguished by one primary seta on the antennal scape; frons with a cluster of setae above antennal insertion; elytral humeral dot, two separate marginal spots and a complete apical lunule.

*Description.*—*General habitus.* Body medium (12–14 mm); dorsum dull greenish black, green, bronze, copper-brown or black; elytral surface granulate, lacking punctures but with intervening shallow depressions, often appearing as small purple dots; maculae as a humeral dot, two separate marginal spots at middle, and a complete apical lunule; body ventrally shiny greenish black, green, bronze or copper. *Head.* Antennal scape glabrous except for subapical primary seta; labrum short, ivory with one long tooth at middle on both sexes, 12 to 16 submarginal setae; clypeus with long appressed setae; frons glabrous except for several long ventrally directed setae above antennal insertion; vertex finely rugose with shallow raised parallel ridges at base of eyes, becoming inconspicuous next to eyes and medially; genae covered by long, ventrally directed setae. *Prothorax.* Pronotal surface dorsally smooth, alutaceous and glabrous, laterally margin with long, semierect setae originating from one or two rows of large setigerous punctures; anterior and posterior transverse sulci shallowly impressed laterally, not impressed at center; anterior reflexed margin wide at middle; proepisterna covered with long, erect setae; prosternum with long setae. *Pterothorax.* Female mesepisternal coupling sulcus a narrow groove slightly slanting posteroventrally, uniformly deep along its entire length. *Elytra.* Surface granulate without punctures, intervening impunctate areas shallowly depressed, often appearing as small purple dots contrasting in color with remainder of surface (more obvious on green and brown color morphs); pattern of maculae consisting of a humeral spot (absent on a few specimens), two separate lateral spots of middle third and a narrow apical lunule complete (divided on a few specimens), nearly reaching suture; apex with large microserrulations; sutural spine large; apical margin slightly truncated from outer apical angle to suture and conjointly rounded at suture. *Abdomen.* Sterna laterally covered by thick, semierect setae except for sixth sternum of female with long, fine hairs; all sterna medially almost glabrous. *Legs.* Trochanters shiny purplish black, slightly metallic, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic copper or purplish green. *Male genitalia.* Aedeagus long and slender, slightly bulky on right, widest at middle and uniformly wide beyond middle; apex broadly ending in a large, rounded sclerotized tip bent to the left and raising membranes on the left side in left lateral aspect; subapical flange long and abruptly ending at base, situated to the right of center and symmetrically shaped in both left and right lateral aspects below apex; apical orifice short, extending for only one fourth of aedeagus length.



**Geographic variation.**—We recognize two subspecies of *Cicindela funerea* from the Indian subcontinent: nominal *Cicindela funerea funerea* copper-brown with white maculae consisting of a humeral spot (on a few specimens absent), two separate marginal spots and a complete apical lunule; *C. funerea assimilis* refers to the greenish black and green subspecies which occurs consistently in the northern part of the Indian subcontinent. We have not considered the other described taxa assigned to this species which occur in Southeast Asia.

**Distribution.**—(Fig. 46). *Cicindela funerea funerea* occurs in the Eastern Ghats of India (Andhra Pradesh) and Chota Nagpur Plateau of east central India (Bihar, West Bengal) eastward into Indonesia. *C. funerea assimilis* occurs along southern base of Himalayas of Nepal and India (Himachal Pradesh, West Bengal, Assam, Arunachal Pradesh, Meghalaya) and Bangladesh eastward into Indochina.

**Localities.**—*Cicindela funerea funerea*. INDIA: Andhra Pradesh: 13 km N Lottugadda Junction, 12, 24.VIII.1985, forest stream edge (DLPC); 30 km N Narsipatnam, 28.VI.1986, forest stream (DLPC); Araku, 90 m, 29.VI.1986, sandy stream edge (DLPC); Bihar: 100 km W Ranchi, 23.VI.1986, forest stream (DLPC); *C. funerea assimilis*. INDIA: Assam: 12 km S Ganhati, 12.V.1985 (DLPC); Kaziranga, Kohora, 2.V.1985 (DLPC); Meghalaya: 13 km N Nongpoh, 5.V.1985 (DLPC); Shillong (UMDE); West Bengal: 25 km N Siliguri, 2.VI.1985, sandy river beach (DLPC); Kurseong, XI.1892 (UMDE). NEPAL: 15 km S Sauraha, 28.V.1986, forest stream (DLPC); 51 km W Kathmandu, 26.V.1986, forest stream (DLPC).

**Ecology.**—Adults are found along sandy streams with forest nearby. Fowler (1912) reported adults inhabited primarily jungle forests. This species is conspicuously absent from the Western Ghats and western portions of the north Deccan highlands where *Cicindela fowleri* occupies the same type of habitat (Pearson and Ghorpade, 1989).

**Remarks.**—*Cicindela funerea assimilis* superficially resembles *C. chloris* in dorsal color, but these two species differ in their elytral surface sculpturing and maculation.

### *Cicindela (Lophyridia) fischeri elongatosignata* Horn

*Cicindela fischeri* Adams, 1817:279.

**Type status.** Syntype(s)? [unexamined; concept based on a specimen! from Koyulhisar, Pontus Region, Turkey, at CMNH]. **Type depositary.** Unrecorded. **Type locality.** Unknown.

*Cicindela fischeri elongatosignata* Horn, 1922:21.

**Type status.** Syntypes [unexamined; concept based on specimens! from Makran District, Baluchistan, Pakistan, at NMNH]. **Type depositary.** ?DEI. **Type locality.** "Transkaspien (Oase Tedschen)."

*Lophyridia fischeri* (Adams): Rivalier, 1950:238.

*Lophyridia fischeri elongatosignata* (Horn): Naviaux, 1983:81, fig. 12, 38, 65.

**Diagnosis.**—Distinguished by the standard pattern of elytral maculae; elytral humeral lunule divided; setose clypeus and frons; one seta on antennal scape.

**Description.**—**General habitus.** Body small to medium (9–11 mm); body bronze, copper-green, brown, green, or black; elytral maculae forming a standard but divided pattern. **Head.** Antennal scape glabrous except for one subapical primary seta; labrum short, ivory, one tooth medially on anterior margin, tooth long on female and short on male; 16 to 24 submarginal labral setae; clypeus setose; frons with numerous moderately raised and longitudinally parallel ridges extending onto vertex near eyes but becoming shallower and irregular medially; genae covered by long, ventrally directed setae. **Prothorax.** Pronotum wider than long with anterior and posterior transverse sulci shallowly and irregularly impressed, both wider and shallower at middle and projecting along central line; pronotal surface dorsally with large shallow wrinkles, laterally roughened; disc glabrous; lateral and anterolateral margins with long, semierect setae originating from one or two irregular rows of large setigerous punctures and extending one-third the distance between edge and middle; propisterna covered with

long, dorsally directed, semierect and appressed setae; prosternum with long setae especially medially. *Pterothorax*. Female mesepisternal coupling sulcus a narrow, sinuate groove deepest ventrally near posterior margin. *Elytra*. Surface granulate-punctate, numerous small granules between and near minute purple punctures of similar depth basally and apically on disc; humeral lunule divided on most specimens (complete on a few specimens), discal dot situated laterad; middle band short, transverse portion mesad separated from medial spot situated near suture but laterad connected to marginal line, the latter expanded anteriorly and posteriorly along margin; apical lunule complete, anterior projection oblique, posterior portion enlarged near suture; microsculptulations large; apical margin on both sexes rounded from outer apical angle toward apex; sutural spine large. *Abdomen*. Anterior five female sterna and all male sterna covered with long, appressed setae except at middle, sixth female sternum with long hairs. *Legs*. Trochanters shiny black, greenish metallic reflections, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic copper-green and green; anterior four femora on distal half with many setae along posterior margin bent back proximally at a right angle, numerous other setae along remainder of the length bent distally in the same manner. *Male genitalia*. Aedeagus long, widest on middle third, tapering gradually at apex to a broad, flattened tip; tip sclerotized on the right side in left lateral aspect and extending as a short acute partially sclerotized bulge to the left and raising membranes on the left side at the distal end of the apical orifice; subapical flange small and symmetrical in both left and right lateral aspects; flange medially situated, abruptly raised on proximal surface and gradually tapering at distal end; parameres extending beyond middle of aedeagus.

*Distribution*.—(Fig. 45). Nominal *Cicindela fischeri* occurs in eastern Europe across Turkey into Armenia S.S.R., U.S.S.R.; *C. fischeri elongatosignata* found in Turkey, Iraq, Iran and Afghanistan and enters the Indian subcontinent along the southern Pakistan coast (Baluchistan).

*Localities*.—TURKEY: Pontus Region: Koyulhisar along Kelkit River, 16.VIII.1987 (CMNH). AFGHANISTAN: Herat Province: Bala Murghab, 12.VII.1964, and 8.VIII–8.IX.1964, 470 m (NMNH); Kabul Province: Lalanda, 12.V.1967, 2250 m (NMNH). PAKISTAN: Baluchistan: Makran District, 47 mi S Paron, 1–4.III.1965 (NMNH).

*Ecology*.—Naviaux (1983) reported adults of this species occurred near water at low and middle elevations.

### *Cicindela (Lophyridia) littoralis conjunctaepustulata* Dokhtouroff

*Cicindela littoralis* Fabricius, 1787:185.

*Type status*. Lectotype, female [here designated]. *Type labels*. “Marocca., Vahl., Mus: J.S.T.L., Littoralis, F.” [handwritten within two, thin black lines near borders]; “TYPE” [typeset red label]; “ZOOLOG. MUS., KOBENHAVN” [typeset]; “Cic., lunulata Fabr., det. Ing. Mandl, V-Form” [first and third lines typeset, remainder manuscript]; “Name besteht zu Recht, nicht syn. mit, lunulata Fabr., Dr. K. Mandl det 1979” [first three lines handwritten and last numeral of date in blue pen, remainder typeset]; “LECTOTYPE, *Cicindela, littoralis* Fabricius, by R.E. Acciavatti, '86” [typed and hand-printed red label]. [Lectotype is 15 mm.] *Type depository*. Lectotype at ZMUC. *Type locality*. “ad barbariae littora” (Barbary Coast, northern Africa).

*Cicindela littoralis conjunctaepustulata* Dokhtouroff, 1887b:438.

*Type status*. Syntype(s)? [unexamined; concept based on specimens! from Iran, Fars Province, at CMNH]. *Type depository*. Unrecorded. *Type locality*. “Bassin superieur de fleuve Bleu (Yangtzekiang), 13,500–14,000 p.d'alt.” (Plateau of Tibet, China).

*Lophyridia littoralis conjunctepustulata* (sic) (Dokhtouroff): Mandl, 1981b:131.

*Lophyridia littoralis conjunctaepustulata* (Dokhtouroff): Naviaux, 1983:82, fig. 15, 42, 62.

*Diagnosis*.—Distinguished by the elytral maculae separated into large spots; setose clypeus; numerous setae on antennal scape.

*Description*.—*General habitus*. Body medium (10–15 mm); head and pronotum dark brown, nearly black or greenish bronze; elytral maculae separated into large and oval remnants of the standard pattern; body greenish purple ventrally. *Head*. Antennal scape with numerous appressed setae besides subapical primary seta; labrum short, ivory, single tooth medially at anterior margin; 16 to 24 sub-

marginal setae; clypeus setose; frons and vertex rugose with moderately raised and parallel ridges near eyes, shallower and irregular between eyes; rugae inconspicuous on frons; genae covered by long, ventrally directed setae; eyes small, bulging only slightly. *Prothorax*. Pronotal surface with large, shallow wrinkles and glabrous dorsally; lateral margin with long, semierect setae originating from numerous, irregular rows of large setigerous punctures; anterior and posterior transverse sulci shallowly impressed; anterior and posterior reflexed margins only slightly widened at middle; proepisterna covered by long, erect setae; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a narrow groove, slanting posteroventrally, deepest ventrally, obscure near ventral margin. *Elytra*. Surface granulate-punctate with moderately large granules; minute purple punctures shallow basally and on disc, barely visible apically; maculae varied, on most specimens six spots on each elytron represent ends of humeral lunule and four parts of middle band, apical lunule narrowly complete; on a few specimens humeral and apical lunules, and basal portion of middle band narrowly complete; apex with large microserulations; sutural spine small; apical margins evenly rounded. *Abdomen*. All sterna covered by appressed setae and long hairs, thicker and more abundant laterally. *Legs*. Trochanters dark shiny blackish purple, slightly metallic, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic copper-green and green; anterior four femora on distal half with many setae along posterior margin bent back proximally at a right angle, numerous other setae along remainder of the length bent distally in the same manner. *Male genitalia*. Aedeagus slender, moderately long, lacking any bulky body wall, widest at middle; apex tapering gradually to a broad blunt sclerotized tip bending to the right side in left lateral aspect and raising membranes on the left at the distal end of the apical orifice; subapical flange entirely absent; parameters extending beyond middle of aedeagus.

*Distribution*.—(Fig. 46). *Cicindela littoralis* is widely distributed in the Palearctic biogeographic region as many subspecies (Mandl, 1981*b*, 1982*b*). *Cicindela littoralis conjunctaepustulata* occupies the central portion of that region and reaches Baluchistan and Sind, Pakistan, with an isolated population reported by Mandl (1981*b*, 1982*b*) from Bombay, India.

*Localities*.—PAKISTAN: Baluchistan: Perso-Baluch Frontier (DLPC). IRAN: Fars Province: 13 km SE Shiraz, 2.VII.1965 (CMNH); Lac de Bakhtegan, 29.IV.1971 (Naviaux, 1983).

*Ecology*.—Adults are found in habitats associated with saline and brackish water. Naviaux (1983) reported this species from the swampy margins of a large saline lake.

*Remarks*.—Mandl (1981*b*, 1982*b*), using structures within the male genitalic inner sac, showed that Indian subcontinent populations belong to *Cicindela* (*Lophyridia*) *littoralis* rather than *Cicindela* (*Lophyridia*) *lunulata* Fabricius, 1781: 283, as earlier authors such as Horn (1926) had thought.

### *Cicindela* (*Lophyridia*) *aulica* Dejean

*Cicindela aulica* Dejean, 1831:250.

*Type status*. Syntype(s)? [unexamined; concept based on specimens! from Karachi, Pakistan, at CMNH]. *Type depository*. ?MNHN. *Type locality*. "Senegal."

*Cicindela aulica* Dejean: Fowler, 1912:374, fig. 164.

*Lophyridia aulica* (Dejean): Rivalier, 1950:238.

*Diagnosis*.—Distinguished by the complete humeral elytral lunule; setose clypeus; glabrous antennal scape (except for primary seta); glabrous frons.

*Description*.—*General habitus*. Body medium (10–12 mm); head and pronotum brown, green, dark copper-green or dark olive-green nearly black; standard pattern of elytral maculae; body shiny copper and bluish green ventrally. *Head*. Antennal scape with appressed setae besides subapical primary seta; labrum short, ivory, with one tooth at middle of anterior margin, long on female and small on male, 16 to 24 submarginal setae; clypeus setose; frons and vertex moderately rugose, parallel ridges near eyes, shallower and irregular between eyes, inconspicuous on frons; genae covered by long, ventrally directed setae. *Prothorax*. Pronotal surface dorsally with large shallow wrinkles, glabrous, lateral and anterolateral margins with long, semierect setae originating from one or two irregular rows of large setigerous punctures; anterior and posterior transverse sulci shallowly and irregularly impressed, both

widened at middle and projecting along central line; proepisterna glabrous along dorsal margin, remainder covered with short, appressed setae; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a large cavity medially along posterior margin. *Elytra*. Surface granulate-punctate with small granules associated with minute purple punctures; granules and punctures most noticeable basally and on disc, barely visible apically; humeral and apical lunules complete; middle band with separate medial spot (narrowly joined on a few specimens), lateral portion expanded anteriorly and posteriorly; large microsculptations; large retracted sutural spine; apical margin slightly truncated from outer apical angle toward apex, abruptly and separately rounded at suture. *Abdomen*. All sterna covered with appressed setae and long hairs which are thicker and more abundant laterally. *Legs*. Trochanters shiny brownish black, slight metallic reflections, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic copper-green and green; anterior four femora on distal half with many setae along posterior margin bent back proximally at a right angle, numerous other setae along remainder of the length bent distally in the same manner. *Male genitalia*. Aedeagus long, extremely slender, lacking any bulky body wall, widest on apical third; apex tapering gradually to a broad, flattened tip, sclerotized on the right side in left lateral aspect and extending as a short acute semisclerotized bulge to the left; tip raises membranes on the left at the distal end of the apical orifice; subapical flange symmetrical in both left and right lateral aspects; flange medially situated, slightly raised in the middle and gradually tapering at each end; parameres extending beyond middle of aedeagus.

*Distribution*. — (Fig. 45). Widely distributed across northern Africa and the Middle East and entering the Indian subcontinent along the southern Pakistan coast (Baluchistan, Sind).

*Localities*. — PAKISTAN: Sind: Karachi, 8–10.VIII.1982, sandspit (CMNH); 1.5 mi W Karachi, 10.VII.1975, sandspit (CMNH).

*Ecology*. — Adults of this species occur in habitats near water.

### *Cicindela (Lophyridia) quadripunctulata* Mandl

*Cicindela quadrimaculata* Mandl, 1969:154 (preoccupied, Sturm, 1826:55).

*Type status*. Holotype, male! *Type labels*. "Indien/Madras, Anamalai (sic) Hills, Cinchona 3500 ft, V.1965, Nathan." [typeset]; "Holo-, TYPUS" [handprinted and typeset red label]; "Cic. quadripunctulata m., det. Dr. K. Mandl 68" [first two lines and date handprinted, remainder typeset, white label]. [Male genitalia removed and glued to a small paper under holotype.] *Type depositary*. Holotype, allotype and paratypes at ZSBS; paratypes at DEI and CMNH. *Type locality*. "India, Madras, Anamalai (sic) Hills, Cinchona, 3500 ft."

*Cicindela quadripunctulata* Mandl, 1971:1 (replacement name).

*Cicindela quadripustulata* (sic) Mandl: Mandl and Wiesner, 1975:93.

*Diagnosis*. — Distinguished by lacking a humeral elytral lunule; setose clypeus; glabrous antennal scape (except for primary seta); glabrous frons.

*Description*. — *General habitus*. Body large (15–16 mm); head and pronotum copper, laterally violet-green; elytra bronze or bronze-green; spots along lateral margin, one at middle, another subapically; body blue-green ventrally. *Head*. Antennal scape glabrous except for subapical primary seta; labrum short, ivory except for a thin black anterior edge with one long tooth at middle on female, tooth small on male, 12 to 16 submarginal setae; clypeus with setae laterally; frons and vertex glabrous, finely rugose with shallow raised parallel ridges at base of eyes, inconspicuous next to eyes and medially; genae covered by long setae, ventrally directed. *Prothorax*. Pronotal surface dorsally smooth, alutaceous and glabrous, lateral margin with long, semierect setae originating from one or two rows of large setigerous punctures; anterior and posterior transverse sulci shallowly impressed laterally, anterior sulcus not impressed at center; anterior reflexed margin wide at middle; proepisterna purple, smooth, entirely glabrous on dorsal two-thirds, ventrally with long, erect setae; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a shallow groove slightly slanting posteroventrally, deepest dorsally, barely evident on ventral half. *Elytra*. Surface finely granulate-punctate with granules extremely small and shallow purple punctures contrasting in color with remainder of surface; maculae greatly reduced without humeral and apical lunules, only with one lateral spot at middle and another subapically on each elytron; apex with large microsculptations, sutural spine small, margin on each sex slightly truncated from outer apical angle to suture and cojointly rounded at suture. *Abdomen*.

Anterior four sterna laterally covered with semierect setae, medially sterna nearly glabrous on both sexes; fifth and sixth female sterna possess long fine hairs, those of male sparsely setose. *Legs*. Trochanters shiny purple black, slightly metallic, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic copper or purplish green. *Male genitalia*. Aedeagus long and moderately slender, gradually enlarged and widest on apical third; apex gradually tapering to a large, rounded sclerotized tip slightly bend to the left; subapical flange medially situated, moderately long, abruptly ending at basal end; flange symmetrical in both left and right lateral aspects near apex; parameres long, extending beyond middle of aedeagus.

*Distribution*.—(Fig. 46). Known only from the type locality in the Anaimalai Hills, western Tamil Nadu, India.

*Localities*.—INDIA: Tamil Nadu: Anaimalai Hills, Cinchona, 1075 m, V.1965 (DEI); Anaimalai Hills, Cinchona, 1075 m, X, XI.1971, IV.1974 (CMNH).

*Ecology*.—The habitat details are unrecorded for adults of this very localized species whose habitat preference is probably restricted to the vicinity of water like related species. The impoundment of numerous watercourses in the Anaimalai Hills may affect the abundance of this endemic species.

### Subgenus *Cicindela* (*Jansenia*) Chaudoir

*Jansenia* Chaudoir, 1865:53.

Type species.—*Dromica westermanni* Schaum, 1861.

*Jansonia* Bates, 1891:7 (emendation).

*Jansonia* (*sic*) Chaudoir: Rivalier, 1961:133.

*Nomenclatural note*.—When Chaudoir (1865) established his genus *Jansenia* for *Dromica westermanni*, he indicated its dedication to Mr. Jansen, then Secretary of the Entomological Society of London. From separate evidence, we have determined that a Mr. E. W. Janson held the position of Secretary. We believe Chaudoir intended to name this genus in honor of Janson, but used the spelling presented here. According to the Code (Section 32) (ICZN, 1985), Chaudoir's spelling of the name is to be preserved unaltered as there is no clear evidence of an inadvertent error in his original publication. Therefore, we re-establish Chaudoir's original spelling while treating *Jansenia* as a subgenus, rather than Bates' emendation which appears unjustified according to the Code (Section 33b) (ICZN, 1985).

*Diagnosis*.—These distinctive features of the male genitalia of *Cicindela* (*Jansenia*) species adults are sufficient to distinguish them from members of other subgenera: 1) aedeagus moderately large relative to overall body size; 2) bulky in form and misshapen, gradually or acutely tapering; 2) apex distinctively hooked in a number of species; 4) inner sac with an extremely long flagellum packed within the aedeagus and forming a complicated series of tilted and rectilinear convolutions which raise several sustained membranes forming two or more superimposed, auricular lobes on the left and right lateral aspects. Externally, the distinguishing adult characters of this subgenus include: 1) a general tendency for a thickened and dilated form of the penultimate segment of the labial palpi with an associated reduction in the size and excessive narrowing of the medial process of the mentum; 2) a long labrum covering most of the mandibles and possessing one to three (middle one on most specimens largest) teeth along the anterior margin on females with a reduction in the number and size of teeth on males, such that the males of many species lack teeth entirely; 3) many individuals exhibiting reduced size and number of mandibular teeth producing asymmetrical

mandibles on one or both sexes; 4) elytral maculation nonstandard and varied pattern; adults of most species lack a humeral macula, individuals of one species with a diffuse testaceous humeral area; remaining maculae on most adults reduced to two spots, one at the middle and one at the outer apical margin; three spots present on adults of one species; one or no spots present on adults of a few species; 5) surface sculpturing on the head and pronotum varied from moderately rugose to densely scabrous, and the elytra may be roughened and irregular in texture due to raised areas with the presence of numerous large setigerous punctures common on adults of many species; 6) head and pronotum on most specimens glabrous with the genae setose only for members of one species whereas the pronotum of members of several species possess sparse, appressed, lateral setae; 7) ventral pleura and sterna varied from nearly glabrous to moderately setose.

*Included species.* — *Cicindela (Jansenia)* species, except for one, are confined to Sri Lanka, peninsular and central India and include the following: *C. (J.) westermanni* (Schauim, 1861); *C. (J.) pseudodromica* Horn, 1932; *C. (J.) corticata* (Putzeys, 1875); *C. (J.) dasiodes*, new species; *C. (J.) semisetigerosa*, new species; *C. (J.) vestiplicata*, new species; *C. (J.) legnotia*, new species; *C. (J.) plagatima*, new species; *C. (J.) ostrina*, new species; *C. (J.) corrugatos*, new species; *C. (J.) cratera*, new species; *C. (J.) cirrhidia*, new species; *C. (J.) stellata*, new species; *C. (J.) laeticolor* Horn, 1904, new rank; *C. (J.) chorioidista*, new species; *C. (J.) prothymoides* Horn, 1908; *C. (J.) crassipalpis* Horn, 1908; *C. (J.) tetrastacta* Wiedemann, 1823; *C. (J.) psarodea*, new species; *C. (J.) rostrulla*, new species; *C. (J.) chlorida* Chaudoir, 1865; *C. (J.) grossula* Horn, 1925; *C. (J.) venus* Horn, 1907; *C. (J.) stuprata* Horn, 1909, new rank; *C. (J.) fusissima*, new species; *C. (J.) chloropleura* Chaudoir, 1865; *C. (J.) viridicincta* Horn, 1894; *C. (J.) azureocincta* Bates, 1878; *C. (J.) rugosiceps* Chaudoir, 1865; *C. (J.) sandurica*, new species; *C. (J.) motschulskyana* Horn, 1915; *C. (J.) indica* Fleutiaux, 1893; *C. (J.) reticulella*, new species; *C. (J.) tetragrammica* Chaudoir, 1865; *C. (J.) applanata*, new species.

#### Key to adults of *Cicindela (Jansenia)* species

1. Terminal segment of labial palpi entirely nonmetallic testaceous; pronotum cylindrical, longer than wide, narrower than head and elytra; anterior transverse sulcus on pronotum deeply and evenly impressed forming an anterior collar ..... 2
  - Terminal segment of labial palpi at least partially dark, often metallic; pronotum subquadrate, wider than long; anterior transverse sulcus on pronotum shallowly impressed at middle on some specimens, deeply and unevenly on others, not forming an obvious anterior collar ..... 4
- 2.(1.) Humeral elytral angle metallic copper or bluish iridescently marked; procoxae and mesocoxae opaque, metallic ..... 3
  - Humeral elytral angle nonmetallic testaceously marked; procoxae and mesocoxae testaceous with only a slight metallic sheen ..... *fusissima*, new species
- 3.(2.) Humeral elytral area iridescent copper-green, contrasting with blue lateral iridescent band; female mesepisternal coupling sulcus a medial pit ..... *stuprata* Horn, new rank
  - Humeral elytral area iridescent blue, merging with blue lateral iridescent band; female mesepisternal coupling sulcus a broad medial groove ..... *venus* Horn



- 4.(1.) Colors on elytral margins and disc abruptly contrasting; lateral margin iridescent blue, blue-green to purple, broadly occupying much of humeral angle; similarly colored but narrower sutural margin; disc bright purplish red or polychromatic; male aedeagal apex not hooked; elytral disc lacking large metallic foveae contrasting with surface color ..... 5
- Colors on elytral margins and disc gradually blending; lateral margin diffuse metallic green to copper (some specimens shiny black to violet and red) narrowly occupying humeral angle; only suture slightly metallic; elytral disc varied in color, either shiny black or dull black, bronze, green or greenish brown but not purplish red or polychromatic; male aedeagal apex hooked for many species; elytral disc on most specimens with large or small metallic foveae contrasting with dark surface ..... 9
- 5.(4.) Iridescent colors of lateral elytral margins interrupted by copper-red or purplish red color intruding from disc ..... 6
- Iridescent colors of lateral elytral margins continuous ..... 7
- 6.(5.) Elytral disc color copper with olive-bronze stripe; pronotum laterally glabrous (a few appressed setae on some specimens) ..... *rugosiceps* Chaudoir
- Elytral disc color entirely purple-red; pronotum laterally with numerous appressed setae ..... *sandurica*, new species
- 7.(5.) Iridescent colors of lateral elytral margins wavy at middle; labrum lacking an abrupt medial carina; femora testaceous, translucent ... *azureocincta* Bates
- Iridescent colors of lateral elytral margins straight at middle; labrum with abrupt, medial carina; femora opaque, metallic ..... 8
- 8.(7.) Pronotum globose, about as wide as long, deep anterior and posterior transverse sulci contrasting in color with disc; iridescence of lateral and sutural elytral margins broadly joined at apex; labrum shiny, polished, that of male without teeth and convex along anterior margin, unidentate on female; elytral maculae two large oval spots ... *chloropleura* Chaudoir
- Pronotum parallel sided, longer than wide with shallow anterior and posterior transverse sulci not contrasting in color with disc; iridescence of lateral and sutural elytral margins separated at apex; labrum dull, copper, that of male feebly tridentate and concave along anterior margin, unidentate on female; elytral maculae small faint dots varied in presence and number, most specimens with two dots, some with three, some without dots ..... *viridicincta* Horn
- 9.(4.) Labrum metallic, roughened, setae originating submarginally and at middle of medial carina ..... 10
- Labrum nonmetallic, on most specimens partially testaceous, on some specimens dull blackish brown, surface smooth, most setae submarginal, only one or two on anterior portion of medial carina ..... 13
- 10.(9.) Elytra immaculate, lacking large metallic foveae; proepisterna glabrous ..... 11
- Elytra with two large medial spots and large metallic foveae on disc; proepisterna setose ..... 12

- 11.(10.) Rugae on vertex of head mostly straight to slightly wavy between eyes; elytra dull with many large smooth impunctate areas on disc and laterally; elytral surface intermixed with small shallow punctures, separated not coalesced, surrounded by a shallow iridescent blue-green and purple depression; pterothorax and abdomen on both sexes sparsely setose ..... *indica* Fleutiaux
- Rugae on vertex of head forming irregular network between eyes; elytra shiny and polished with one or two small impunctate areas only on disc, not laterally; elytral surface intermixed with large deep punctures on disc often coalesced, not surrounded by iridescence; pterothorax and abdomen on most females glabrous and only sparsely setose on male ..... *reticulella*, new species
- 12.(10.) Genae on most specimens sparsely setose ventrally, on a few others glabrous, vertex of head concave with eyes large and prominent, constituting more than one-third of maximum head width across posterior supraorbital setae; female mesepisternal coupling sulcus a shallow medial pit or small cavity; male aedeagal apex tapering abruptly to a short point ..... *tetragrammica* Chaudoir
- Genae glabrous; vertex of head flattened with eyes small and not prominent, constituting less than one-third of maximum head width across posterior supraorbital setae; female mesepisternal coupling sulcus a broad, indefinite groove or shallow dimple along posterior margin; male aedeagal apex drawn out gradually to a long point ..... *applanata*, new species
- 13.(9.) Elytral disc with two small, irregular, and poorly defined dull black areas contrasting with remainder of surface .... *motschulskyana* Horn
- Elytral disc without any such irregular dull black areas ..... 14
- 14.(13.) Elytral maculae absent; labrum long, large abrupt medial carina, dull on most specimens mostly testaceous, on a few specimens mostly dull black with faint testaceous areas on each side of carina ..... *prothymoides* Horn
- Elytral maculae present; labrum short or long, but medial carina broadened or nonexistent and most of its surface testaceous with only edges of labrum, and on a few specimens medial carina, darkened ..... 15
- 15.(14.) Elytra ovate, sides laterally convex, humeral angles nearly obtuse ..... 16
- Elytra rectangular, sides laterally parallel, humeral angles nearly at a right angle ..... 17
- 16.(15.) Two lateral elytral maculae, anterior one rounded and removed from margin, posterior one largest, pear-shaped and touching margin .. *westermanni* (Schaum)
- Three lateral elytral maculae, anterior and posterior ones forming thin narrow bands submarginally, medial one rounded ..... *pseudodromica* Horn
- 17.(15.) One or two lateral elytral spots ..... 18
- Three lateral elytral spots ..... *crassipalpis* Horn
- 18.(17.) Transverse middle elytral band present, extending from lateral margin nearly to suture; elytral surface abruptly changing from densely and deeply punctate anterior to middle band to impunctate posterior to middle band; metallic elytral foveae absent ..... *grossula* Horn



- Transverse middle elytral band absent, rather spots laterally positioned (on some specimens joined, on a few specimens a minute humeral dot present); elytral surface on some specimens gradually changing from deeply to shallowly punctate, on other specimens punctures of constant depth; metallic elytral foveae often present . 19
- 19.(18.) Elytral surface rough and unevenly contoured, especially on disc; some specimens with one or more narrow longitudinal furrows creating abruptly raised and irregular ridges on basal two-thirds, and numerous, irregular coarsely raised areas mostly on apical third; other specimens with one shallow longitudinal furrow extending from depression at inner humeral angle to form a broad, slightly raised and regular longitudinal area medially, often contrasting in color and texture with surrounding surface; other specimens with only a few slightly raised areas apically ..... 20
- Elytral surface evenly contoured, the disc entirely lacking any surface irregularities or contrasting colors ..... 26
- 20.(19.) Large, deep dense elytral punctures throughout only slightly smaller, shallower and sparser apically; subsutural metallic foveae obscured by punctures of nearly the same size; several punctures joined within numerous short transverse grooves nearly obliterating the narrow sutural ridge, especially on apical half; male aedeagal apex acute, apical hook short, slender, gradually recurved; female proepisterna shallowly wrinkled, only a few setae near ventral margin; female mesepisterna smooth, polished, coupling sulcus a small, moderately deep pit posterior to middle ..... *corticata* (Putzeys)
- Large, deep dense elytral punctures mostly on basal half, obviously smaller, shallower and sparser apically; subsutural metallic foveae visibly larger than basal punctures; punctures on most specimens discrete, on some specimens a few punctures joined at several places basally to form short grooves impinging upon sutural ridge but not obliterating it; male aedeagal apex on some specimens acute with a slender abruptly recurved hook, on other specimens apex broad with a long, wide gradually recurved hook; female proepisternal surface wrinkled, on some specimens sparse setae throughout; female mesepisternal surface wrinkled, coupling sulcus a small, shallow dimple or slight depression medially ..... 21
- 21.(20.) Elytral surface rough and unevenly contoured on disc with two narrow irregular longitudinal ridges on basal two-thirds, and numerous small, irregular, coarsely raised areas apically ..... 22
- Elytral surface with only slight uneven contours on disc with one broad longitudinal ridge, regular in width on basal two-thirds becoming irregular apically, one to several large slightly raised areas apically ..... 24
- 22.(21.) Proepisterna with shallow parallel wrinkles confined to dorsal margin, and noticeably shallower than moderately impressed parallel rugae at lateral edge of pronotum; mesepisterna on most specimens with sparse decumbent setae scattered over the surface ..... *dasiodes*, new species
- Proepisterna with moderately impressed wavy wrinkles from dorsal edge extending ventrally to cover most of dorsal half, and wrinkled

- surface dorsally about as coarse as that at lateral edge of pronotum; mesepisterna almost glabrous, no more than a few decumbent setae near lower posterior margin ..... 23
- 23.(22.) Elytral foveae metallic blue-green in two sparse irregular rows, one on each side of medial ridge; male aedeagal apex acute, apical hook abruptly recurved, recurved section short and flattened ..... *semisetigerosa*, new species
- Elytral foveae metallic blue-green in one sparse row on sutural side of medial ridge, a few specimens with one fovea on lateral side; male aedeagal apex broadly rounded, apical hook gradually recurved, recurved section short and slightly concave ... *vestiplicatica*, new species
- 24.(21.) Proepisternal wrinkles moderately impressed, wavy from dorsal edge extending ventrally to cover most of surface, and wrinkled surface dorsally about as coarse as that at lateral pronotal edge; proepisterna mostly setose with setae originating from small setigerous punctures over most of its surface on male, only on ventral half on female; female mesepisterna coarsely wrinkled, coupling sulcus varied, on some specimens a small, shallow circular dimple medially, on others no dimple present; male aedeagal apex acutely rounded, apical hook abruptly recurved, recurved section very long and flattened ..... *legnotia*, new species
- Proepisternal wrinkles shallow, parallel, confined to dorsal margin, noticeably shallower than moderately impressed parallel rugae at lateral pronotal edge; proepisterna mostly glabrous with setae originating from large setigerous punctures only on ventral half on male, only near ventral margin on female; female mesepisterna slightly wrinkled, each with a small, shallow circular dimple medially; male aedeagal apex broadly rounded, apical hook gradually recurved, recurved section short, thickened, slightly concave in cross section . 25
- 25.(24.) Elytral disc partially shiny black, interrupted by a narrow copper or copper-green streak along line of foveae between the broad black longitudinal ridge and broad black subsutural band, laterally with a broad copper-green margin flanked by a narrow purple edge, suture copper; distal end of femora with the boundary between testaceous and unpigmented portions distinctly defined on all surfaces ..... *plagatima*, new species
- Elytral disc uniformly shiny black, laterally with a broad copper or copper-green lateral band flanked by a broad purple margin, suture black; distal end of femora with the boundary between testaceous and unpigmented portions poorly defined on posterior surface ... *ostrina*, new species
- 26.(19.) Colors at lateral elytral margins and disc abruptly contrasting; marginal color varied; some specimens with several narrow iridescent violet, blue, green and red bands, violet band extending uniformly to the humeral angle; other specimens with one wide metallic copper, purple, blue or green band, reaching at least to middle of lateral spots; margins highly polished with numerous punctures, contrasting abruptly in texture, luster and color with remainder of surface ... 27
- Colors at lateral elytral margins and disc gradually merging; on any specimens no more than a narrow violet edge not reaching humeral

- angle; shiny diffuse margins gradually merging in texture, luster and color with remainder of surface ..... 30
- 27.(26.) Elytral disc shiny black or copper-black, lateral margins widely violet, blue, green and red iridescence uniformly tapering anteriorly to humeral angle and posteriorly to outer apical angle; male aedeagal apex broadly rounded, apical hook gradually recurved; male with proximal second and third pro- and mesotarsomeres pilose ventrally; female mesepisterna coupling sulcus a large elongate pit near posterior margin ..... *tetrastacta* Wiedemann
- Elytral disc dull black, bronze, or green to greenish brown, lateral margins narrowly metallic copper, purple, blue or green; male aedeagal apex lacking an apical hook; male with only proximal second and third protarsomeres pilose ventrally; female mesepisterna each with a small circular dimple or slight depression medially ..... 28
- 28.(27.) Elytral disc green to greenish brown, contrasting foveae absent; lateral elytral margin broadly metallic copper ..... *chlorida* Chaudoir
- Elytral disc black, bronze or copper, contrasting foveae green, blue or purple in an irregular subsutural row, additional foveae medially, especially on apical third and at inner humeral angle; lateral elytral margins broadly metallic purple to bluish and copper-green ..... 29
- 29.(28.) Femora opaque, metallic copper-green except at extreme distal end; labrum tawny except for wide black border along entire anterior margin and extending onto medial carina for both sexes ..... *psarodea*, new species
- Femora translucent, testaceous throughout entire length; labrum uniformly tawny over entire surface, narrowly darkened along entire anterior edge and barely onto medial carina for female ..... *rostrulla*, new species
- 30.(26.) Femora pale and testaceous; entirely translucent throughout the entire length on all surfaces on some specimens; partially translucent, metallic shine in certain lighting on dorsal or lateral surfaces on other specimens; short testaceous semitranslucent portion at distal end of femora diffuse, not abruptly contrasting with remainder of length on all surfaces ..... 31
- Femora opaque and dark; metallic copper on most specimens; greenish black throughout the entire length on all surfaces on some specimens; short testaceous semitranslucent portion at distal end abruptly contrasting with remainder of length on all surfaces ..... *corrugatosa*, new species
- 31.(30.) Elytral maculae large, broadly touching lateral margin; anterior spot elongate and posterior spot oblong with a long, apical extension; elytra typically with numerous metallic blue-green foveae medially in addition to a subsutural row ..... 32
- Elytral maculae small, not touching lateral margin; anterior and posterior spots oval, the latter with a short apical extension only on a few specimens; elytra typically with only a subsutural row of metallic blue-green foveae, on a few specimens with one or two medial foveae ..... 34
- 32.(31.) Lateral elytral margins broad, copper and narrower blue-green and violet edge all reaching humeral angle; elytral punctures large, deep

- and dense over most of the surface; mesepisterna with numerous sparse setae on ventral half; prosternum with sparse setae anterior to procoxae; pronotum with sparse setae laterally especially at anterior margins on male, entirely glabrous on female; male aedeagal apex tapering broadly and uniformly to a large gradually rounded tip, apical hook gradually recurved at a broad angle, recurved section wide; female mesepisternal surface slightly wrinkled, coupling sulcus a minute, shallow circular pit medially ..... *cratera*, new species
- Lateral elytral margins narrow, blue-green edge not reaching humeral angle; elytral punctures largest and densest only basally becoming shallower and sparser apically; mesepisterna glabrous or with a few setae on ventral half; prosternum glabrous; pronotum entirely glabrous on both sexes; male aedeagal apex not both broadly and uniformly tapering to tip, apical hook gradually recurved at shallow angle, recurved section narrow; female mesepisternal surface on some specimens coarsely wrinkled and lacking a medial pit, surface on other specimens slightly wrinkled with small shallow circular pit medially ..... 33
- 33.(32.) Femora entirely translucent, pale and testaceous throughout their entire length on all surfaces (slight metallic tinge on a few specimens in certain lighting); broad male aedeagus narrowed just before apex, apical hook shallowly recurved, recurved section long and slender; female mesepisternal surface slightly wrinkled, coupling sulcus a small, shallow circular pit medially ..... *cirrhidia*, new species
- Femora partially translucent pale and testaceous with a metallic shine on dorsal or lateral surfaces; broad male aedeagus uniformly wide to apex, apical hook slightly and acutely recurved, recurved section very short and narrow; female mesepisternal surface coarsely wrinkled, coupling sulcus a minute depression medially ..... *stellata*, new species
- 34.(31.) Elytral disc dark, dull bronze with large dense punctures on basal half abruptly becoming smaller and sparser in vicinity of anterior spot; labrum pale with the anterior margin darkened; male mesepisterna glabrous; hooked apex of male aedeagus gradually recurved, recurved section uniformly tapered, nearly semicircular in cross section ..... *laeticolor* Horn, new rank
- Elytral disc shiny, bright copper to copper-green with large, dense punctures on basal half gradually becoming smaller and sparser in vicinity of anterior spot; labrum uniformly pale without the anterior margin darkened; male mesepisterna sparsely setose; hooked apex of male aedeagus abruptly curved, recurved section flattened and internally concave in cross section ..... *choriodista*, new species

***Cicindela (Jansenia) westermanni* (Schaum)**

*Dromica westermanni* Schaum, 1861:75.

*Type status.* Lectotype, female [here designated]. *Type labels.* "Type" [typeset orange label]; "Tars. antichi supra, haud sulcati, Physodeutera, (Lac.?) Bohem." [handscript]; "41788" [typeset]; "Westermanni, Schaum, Coroman." [handscript yellow label]; "Zool. Mus., Berlin" [typeset]; "LECTOTYPE,

*Dromica, westermanni* Schaum, by R.E. Acciavatti, '85" [typed and handprinted red label]; "*Cicindela, westermanni* (Schaum), det., R.E. Acciavatti, 1985" [typewritten]. [Lectotype is 10 mm; all appendages intact.] Paralectotypes, two males at ZMUC each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]; one male also labelled "Mus. Westerm." [typeset]; "Type" [typewritten red label]; "Coroman, del., von Teyling., Westerman, ni, Schaum" [handscript]; "Zool. Museum, DK Copenhagen" [typeset]; "*Cicindela, westermanni* (Schaum), det., R.E. Acciavatti, 1985" [typewritten]; remaining male at ZMUC similarly labelled. [Paralectotypes each 10 mm.] *Type depository*. Lectotype at MNHB; two paralectotypes at ZMUC. *Type locality*. "Between Tranquebar and Madras" (Coromandel Coast, Tamil Nadu, India).

*Jansenia westermanni* (Schaum): Chaudoir, 1865:53.

*Cicindela westermanni* (Schaum): Fowler, 1912:332.

*Jansonia westermanni* (Schaum): Rivalier, 1961:134.

**Diagnosis.**—Distinguished by the ovate elytra; two maculae at lateral margin behind the middle.

**Description.**—*General habitus*. Body medium (10–11 mm); head and pronotum copper; elytra ovate, dull black on disc, shiny copper at lateral margins with two lateral spots; body metallic blue-green ventrally. *Head*. Glabrous; vertex and frons with numerous coarse rugae forming irregularly arranged wavy and straight patterns; labrum long, testaceous except for dark area centrally at anterior margin; six to eight submarginal setae; medial carina broad; female labrum, single acute medial tooth; male labrum without teeth, anterior margin straight; medial process of the mentum very short, broadly acute; mandibles of each sex four-toothed distad basal molar; male mandibles mostly ivory, teeth darkened; female mandibles, basal half ivory, remainder darkened. *Prothorax*. Pronotal disc with numerous, coarse wavy and straight rugae; laterally with sparse setae originating from small punctures arrayed in several widely spaced, irregular rows; proepisterna covered by broad, shallow and wavy rugae, sparse appressed setae originating from small punctures; prosternum glabrous and smooth. *Pterothorax*. Female mesepisterna glabrous, coupling sulcus a broad groove dorsally, flattened ventrally; pleura and sterna sparsely covered with appressed setae. *Elytra*. Shape ovate; surface evenly contoured, dull, blackish bronze dorsally, shiny copper-green sublaterally with two spots on each elytron behind the middle, the anterior one slightly mesad, posterior one largest and touching lateral margin; small green punctures on elytral disc interspersed with large green foveae, punctures shallow apically, much larger and denser laterally; small microsculptulations; small blunt sutural spine. *Abdomen*. Sterna laterally with sparse appressed setae, medially glabrous. *Legs*. Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora metallic copper-green except for testaceous area at distal end; tibiae and tarsomeres testaceous tinged with green. *Male genitalia*. Aedeagus large, very bulky and conical, abruptly tapering to a narrow apex; apical hook displaced to the right in left lateral aspect, then gradually recurved to the left and tapering to a blunt tip.

**Geographic variation.**—Specimens from the southern portion of its range have a shiny copper-green basal band sublaterally on each elytron which becomes greatly reduced to nonexistent on specimens from the northern portion.

**Distribution.**—(Fig. 47). Southern India (Andhra Pradesh, Karnataka, Tamil Nadu). Reported from Kerala, India, and Sri Lanka by Heynes-Wood and Dover (1928).

**Localities.**—INDIA: Karnataka: Bangalore, 916 m, 16, 23.VII.1978, 25.VIII.1979 (DLPC); Bangalore, 11.IX.1985, old field (DLPC); Hoskote, 20.VI.1986, scrub forest (DLPC); Tamil Nadu: Salem, 23.IX.1978 (DLPC); Coimbatore, 430 m, IX.1976 (CMNH); Andhra Pradesh: 12 km N Eluru, 17.VIII.1985, scrub forest (DLPC); 57 km W Narsipatnam, 1.VII.1986, scrub forest (CMNH); 57 km New Hyderabad, 4.VII.1986, scrub forest (DLPC).

**Ecology.**—This flightless species occurs in open grassy fields and scrub forest where adults are active from July to September only after the northeast monsoon begins. Adults run very quickly to hide under ground foliage and bases of grass bunches when disturbed. Their shape, color and behavior mimic those of female mutillid wasps occurring in the same habitat (Pearson, 1988).

*Cicindela (Jansenia) pseudodromica* Horn

*Cicindela pseudodromica* Horn, 1932:81.

*Type status.* Lectotype, female [here designated]. *Type labels.* "Cotype, W. Horn" [typeset]; "Trichinopoly, Mudukolam, September 1931, P.S.N. Coll." [handscript folded label]; "Syntypus" [typeset red label]; "DEI, Eberswalde" [typeset]; "LECTOTYPE, *Cicindela, pseudodromica* W. Horn, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 11 mm; body glued on rectangular point; left middle leg missing; labrum broken.] Paralectotype, female at BMNH [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository.* Lectotype at DEI; paralectotype at BMNH. *Type locality.* "Trichinopolis, Mudukolam" (Tiruchchirappalli, Tamil Nadu, India).

*Diagnosis.*—Distinguished by the ovate elytra with three yellow submarginal maculae; medial elytral spot oval; two short submarginal bands, one extending basally, the other apically.

*Description.*—*General habitus.* Body medium (11 mm); head and pronotum copper-brown; elytra ovate; surface dull black on disc, laterally copper; central spot and two short longitudinal bands near margin; body metallic blue-green ventrally. *Head.* Glabrous except for supraorbital setae; vertex with numerous coarse, wavy and straight rugae. *Prothorax.* Pronotum with numerous coarse, wavy and straight rugae; proepisterna glabrous on dorsal half. *Pterothorax.* Female mesepisternal coupling sulcus a broad indistinct groove ventrally and a distinctly narrowed groove dorsally. *Elytra.* Shape ovate with an obtuse humeral angle; surface dorsally with a narrow impunctate velvety black disc through which runs a sutural row of green foveae, laterally copper with numerous green foveae; maculae yellow, forming a round spot medially on elytra and two short, sublateral bands aligned longitudinally, the anterior one ending before the humeral angle, the posterior one not reaching the apical spine; hind wings absent. *Abdomen.* Sterna laterally with sparse appressed setae, medially glabrous. *Legs.* Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora metallic reddish green except for testaceous distal end; tibiae and tarsomeres testaceous. *Male genitalia.* Not examined.

*Distribution.*—(Fig. 47). Known only from the syntypes collected in south central Tamil Nadu, India.

*Localities.*—INDIA: Tamil Nadu: Tiruchchirappalli District, Mudukolam, IX.1931 (DEI, BMNH).

*Ecology.*—The habitat is unrecorded; possibly similar to *C. westermanni* in habitat preference but a later period of adult activity.

*Cicindela (Jansenia) corticata* (Putzeys)

*Euryoda corticata* Putzeys, 1875:69.

*Type status.* Lectotype, male [here designated]. *Type labels.* "Ceylan, (second line illegible)" [handscript]; "E. corticata Pz." [handscript]; "δ" [printed on small square]; "spec. ignote, Euryoda" [handscript, 'Euryoda' underlined]; "Soc. Ent. Belg., Coll. PUTZEYS" [typeset within thin black border]; "TYPE" [typeset red label]; "cf. An. Soc. Ent., Belg. 1875 p. LXXIX" [handprinted]; "E. corticata Putz., det. J. Putzeys" [first line handscript, second typeset]; "sec. W. Horn Cat. Junk 1926, CIC-INDELA, corticata Putz." [first two lines typeset, third handscript]; "LECTOTYPE, *Euryoda, corticata* Putzeys, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 7.5 mm; both hind legs missing.] *Type depository.* Lectotype at IRSNB. *Type locality.* "Ceylan" (Sri Lanka).

*Cicindela corticata* (Putzeys): Horn, 1904:32.

*Jansonia corticata* (Putzeys): Rivalier, 1961:134.

*Jansonia corticata* (Putzeys): Naviaux, 1984b:70, fig. 41–43.

*Diagnosis.*—Distinguished by the rough, uneven elytral surface sculpturing; elytral disc with a longitudinal furrow and irregular raised areas apically; sutural punctures nearly coalesce to form short, transverse, impunctate ridges impinging on apical third of the sutural ridge, obliterating it at the apex; dense punctures

from base to apex; two oblong lateral elytral maculae on apical half; darkened, metallic femora; apical hook on male aedeagus short, gradually recurved.

*Description.*—*General habitus.* (Fig. 9). Body very small to small (7.5–8.5 mm); head and pronotum bright copper dorsally, iridescent blue-green laterally; elytra shiny, disc black to copper-black, often streaked longitudinally with copper color (on some specimens copper-green), surface uneven, maculae as two spots near lateral margin on apical half; body ventrally shiny purple and blue-green. *Head.* Male mandibles three-toothed distad basal molar, mostly ivory with only teeth darkened; female mandibles asymmetrical, right mandible as on male, left mandible with small fourth tooth just beyond basal molar, basal half ivory, remainder darkened; eight to ten straight rugae on vertex adjacent to eyes; wavy rugae medially on vertex meeting transverse rugae extending from frons; six to eight submarginal labral setae originating from large metallic setigerous punctures, male labrum lacking teeth, concave anteriorly, female labrum with one long medial tooth, unpigmented except for slight dark anterior margin divided by a broad unpigmented medial carina. *Prothorax.* Pronotum finely and densely scabrous from irregular pattern of wavy ridges on disc and parallel grooves laterally; pronotum glabrous dorsally; male pronotum very sparse setae laterally; female pronotum glabrous; proepisterna purple, smooth except for large setigerous punctures over most of its surface on male, only on ventral quarter on female, and covered with shallow wrinkles at extreme dorsal margin not forming distinctive wavy pattern; prosternum transversely wrinkled, glabrous except for one or two small setae anterior to procoxae. *Pterothorax.* Female mesepisterna smooth and shiny, coupling sulcus a small moderately deep pit medially; male mesepisterna slightly wrinkled and glabrous except for a few setae at extreme posteroventral margin. *Elytra.* Surface uneven; broad, shallow, longitudinal furrow medially on basal half and irregular raised areas on apical third; elytra shiny, disc black dorsally often streaked longitudinally with copper color (on some specimens copper-green), laterally diffuse green, blue and purple iridescence along entire margin; two circular yellow-white spots on apical half close to lateral margin but separated from it by iridescence; elytral surface with dense distinct punctures from base to apex, punctures largest, deepest and densest basally, smaller and moderately deep apically, smooth and polished at extreme base; punctures near suture nearly coalescing in groups of three to six to form short, transverse, impunctate ridges impinging on sutural ridge on apical third and obliterating it at apex; irregular row of subsutural green foveae and several in depression at inner humeral angle nearly obscured by large surface punctures; elytral apex truncated, more so on female than on male; small microsculptulations; small acute sutural spine. *Abdomen.* All sterna, except terminal one, with moderate white appressed setae laterally, glabrous medially. *Legs.* Trochanters testaceous, one subapical seta on each front and middle segment; tibiae and tarsomeres dark metallic black. *Male genitalia.* Aedeagus moderately bulky, widest on middle third, apical third uniformly wide, narrowing abruptly to an acute apex; short slender rounded apical hook gradually recurved to the left side in left lateral aspect; recurved section 0.2 mm long, broadly tapering, flattened in cross section and not lying next to apex.

*Distribution.*—(Fig. 47). Southern Sri Lanka (Ratnapura, Moneragala, Hambantota districts).

*Localities.*—SRI LANKA: Kataragama, 31.X.1983, 1.XI.1983 (RNC, CMNH); Ratnapura District: Uggalkaltota, 155 m, 10 to 14.X.1970 (NMNH); Trail to Wavulpane Cave, 615 m, 23.X.1976, on trail (NMNH); Wavulpane, 555 m, 18.X.1970 (NMNH); Maduvanwala near Kolonne, 310 m, 17.X.1970 (NMNH); Hambantota District: Hambantota, 5 m, 28.X.1970 (NMNH); Moneragala District: Angunakolapelessa, 100 m, 30.IX–1.X.1973 (NMNH).

*Ecology.*—Adults occur in forests during late September through November.

*Remarks.*—Previous authors, confused about the exact nature of this species, thought *Cicindela corticata* had a wide range over southern India and Sri Lanka. However, our studies indicate that these populations represent a complex of previously undescribed species distinctively different on their male aedeagal apex and female mesepisternal coupling sulcus.

### *Cicindela (Jansenia) dasiodes*, new species

*Diagnosis.*—Distinguished by the shiny, darkened elytra with two lateral maculae; very rough and unevenly contoured elytral surface sculpturing; deep dense elytral punctation only on basal half; elytral surface black and copper streaked;



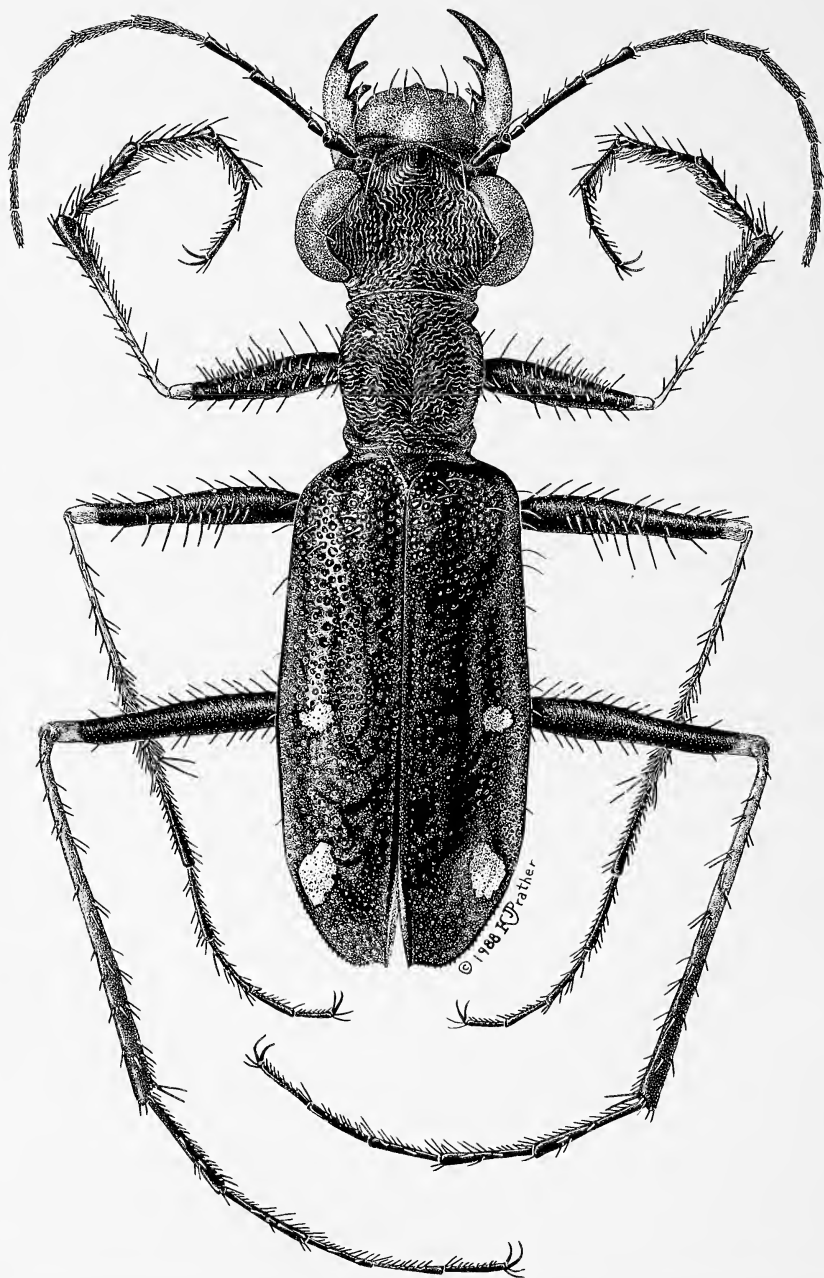


Fig. 9.—*Cicindela (Jansenia) corticata* (Putzeys), male from Kataragama, Sri Lanka. (Body size, 8.0 mm.)



proepisternal surface smooth on dorsal half; apical hook on male aedeagus small, abruptly recurved, flattened against apex; mesepisterna on both sexes sparsely setose; female mesepisternal coupling sulcus a shallow medial dimple.

*Description.*—*General habitus.* (Fig. 10). Body small to medium (8.5–10.5 mm); head and pronotum dorsally copper, laterally blue-green; elytra dorsally shiny black often streaked longitudinally with copper color (some specimens copper-green), elytral surface very rough and unevenly contoured; elytral maculae varied; most specimens as two lateral spots, one at middle and one at outer apical angle; on some specimens anterior spot absent, on others both spots absent; body shiny metallic blue-green and purple ventrally. *Head.* Mandibles of each sex asymmetrical distad basal molar; right mandible with three teeth, left mandible with minute fourth tooth just beyond basal molar; male mandibles mostly ivory with only teeth darkened; female mandibles with basal half of surface ivory, remainder darkened; labrum long, nonmetallic testaceous, only anterior edge of medial carina darkened, surface smooth; medial carina broad; 8 to 11 setae originating from large metallic setigerous punctures, mostly submarginal with only a few on anterior portion of the medial carina, female with one medial tooth, male lacking teeth with anterior margin evenly rounded; penultimate segment of labial palpi dilated, non-metallic, terminal segment small, dark brown to black; frons with coarse, transverse and wavy rugae; vertex with very coarse wavy rugae, those adjoining eyes largest and parallel, those at middle smaller and irregular, slightly transverse; surface entirely glabrous except for two pairs of supraorbital setae. *Prothorax.* Pronotum with surface finely and densely scabrous due to irregular wavy ridges on disc and transverse parallel grooves laterally, often very sparsely setose at anterior lateral angle; proepisterna with large setigerous punctures covering at least ventral half and more often ventral three-quarters of surface, dorsal margin very smooth, no more than shallow parallel wrinkles meeting deeply impressed, transversely parallel grooves at lateral edge of pronotum; prosternum glabrous, except for aberrant seta anterior to coxae on a few specimens, surface transversely wrinkled. *Pterothorax.* Mesepisterna on most males sparsely setose, decumbent setae scattered over surface; female mesepisterna smooth, lacking wrinkles; coupling sulcus a shallow medial dimple. *Elytra.* Surface rough and unevenly contoured, especially on disc; two narrow longitudinal furrows create abruptly raised and irregular ridges on basal two-thirds; numerous irregular coarsely raised areas mostly on apical third; deep dense punctures only on basal half; punctures shallow and sparse apically; smooth and polished at extreme base; elytral disc shiny black dorsally often streaked longitudinally with copper color (some specimens copper-green); elytra with an irregular subsutural row of metallic blue-green foveae and several in depression at inner humeral angle, contrasting with dark surface and a diffuse iridescent copper, green and purple lateral margin; two elytral maculae present at lateral margin, anterior one at middle on most specimens smaller, posterior one larger and situated at outer apical margin; elytral apex truncated, more so on female than male; small distinct microsculptulations; small sutural spine. *Abdomen.* Sterna with sparse appressed setae laterally on anterior five on female and all six on male. *Legs.* Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora metallic copper dorsally and black-green ventrally, except for an abruptly separated testaceous distal end; tibiae testaceous with sooty black distal end; tarsomeres dull black to shiny greenish black. *Male genitalia.* Aedeagus moderately bulky and very wide on middle third, gradually tapering toward apex; apex slightly acute on some specimens, broadly rounded on others (refer to geographic variation); short apical hook, abruptly recurved at a sharp acute angle to left side in left lateral aspect; recurved section 0.09 to 0.125 mm long, flattened in cross section and lying against apex.

*Body size.*—*Holotype.* Body length 9.6 mm, elytral width 3.0 mm. *Allotype.* body length 10.5 mm, elytral width 3.9 mm.

*Type locality.*—Bangalore, Bangalore District, Karnataka, India.

*Type specimens.*—*Holotype*, male, labelled “INDIA, Karnataka, 15 km N Bangalore, 12.VI.1983, D.L. Pearson; forest path”; “HOLOTYPE, Cicindela, dasiodes, Acciavatti & Pearson” [typed and handprinted red label]. *Allotypic* female and 18 paratypes with the same label data. Additional 102 paratypes labelled as follows: “INDIA, Bangalore, 916 m, 10.VI.1979, 12.VI.1980, 20.VII.1980”; “Bangalore, 916 m, 20.VII.1980”; “INDIA, Karnataka, 15 km N Bangalore, 11.IV.1983, 12.IV.1983, D.L. Pearson; forest path”; “INDIA, Karnataka, Bangalore, 915 m, 1.VI.1984, 10.VI.1984, 8.VI.1985, 14.VI.1985; forest path”; “INDIA, Karnataka, Bangalore, 915 m, 19.V.1985, 14.VI.1985; scrub forest”; “75

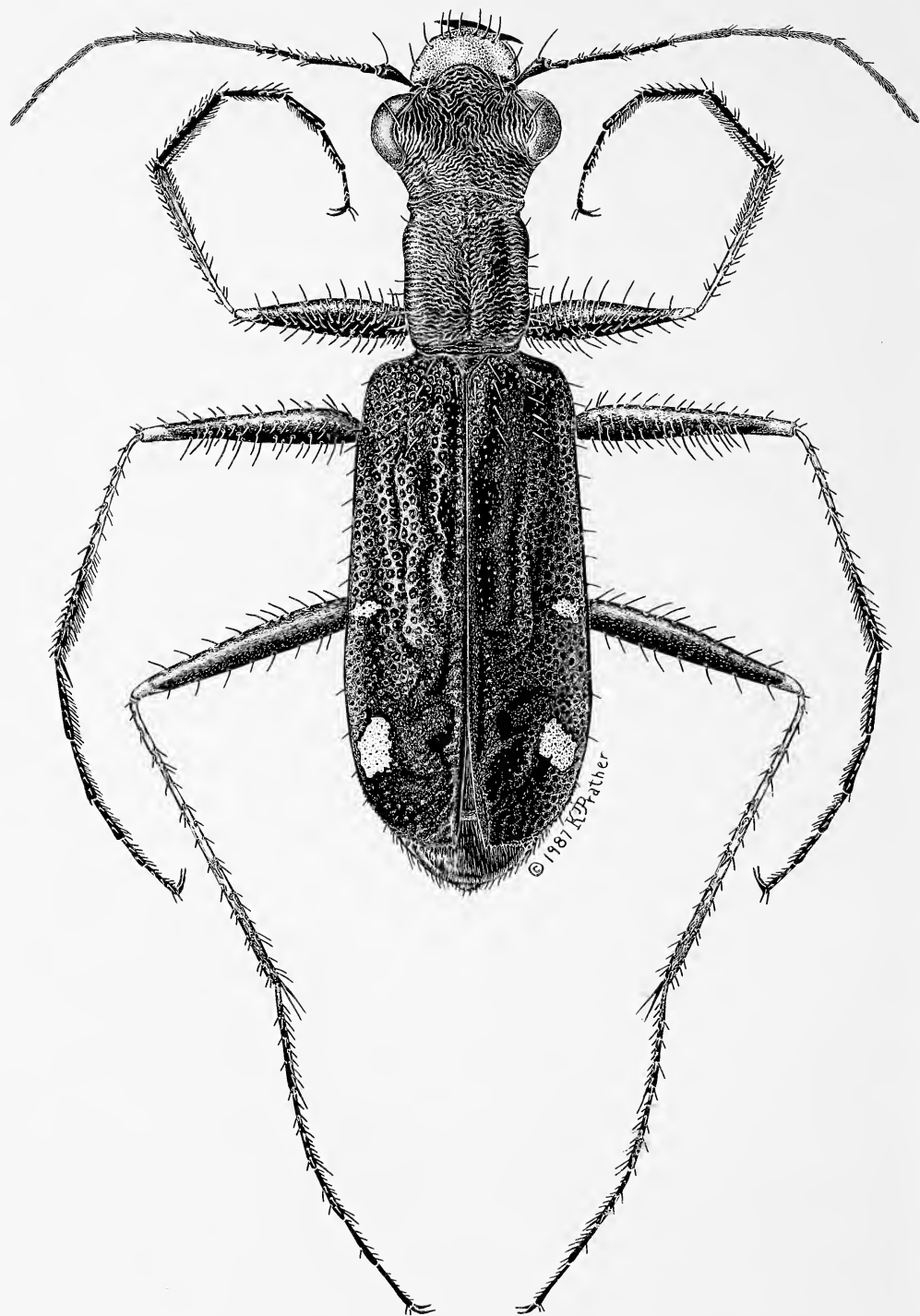


Fig. 10.—*Cicindela (Jansenia) dasiodes*, new species, male holotype from Bangalore, Bangalore District, Karnataka, India. (Body size, 9.6 mm.)

km W Bangalore, 13.VI.1985, D.L. Pearson; scrub forest floor"; "Bangalore, 915 m, 22.VII.1985, T. Shivashankar; scrub forest"; "15 km E Tumkur, 14.VI.1984, 29.VI.1984, D.L. Pearson; scrub forest floor"; "30 km S Kanakapura, 28.VI.1984, D.L. Pearson; forest path"; "Bangalore, 30.V.1985, D.L. Pearson; scrub forest floor"; "Bangalore, 19.V.1985, 12.V.1984, 22.V.1984, 24.V.1984, (G.K.V.K.)."

*Type depository.*—Holotype and 2 paratypes at IARI; allotype and 5 paratypes at NMNH; remaining 113 paratypes distributed as follows: 3 to UASB; 1 to HSC; 16 to CMNH; 93 to DLPC.

*Geographic variation.*—Populations from northeastern Karnataka, near Sandur, generally have reduced or no elytral maculation and a more uniformly shiny black elytral disc with the copper streak confined to the apical third. Males from these populations have a slightly different form to the aedeagal apex. The apical tip is narrower and slightly acute instead of broadly rounded; the recurved section of the apical hook is slightly shorter (0.09 mm instead of 0.13 mm). Populations from western Karnataka, near Kadur and Dharwar south to Shimoga, show intermediate characters in that specimens lacking maculation occur mixed together with maculated individuals, and the male genitalia have either a narrow or broad aedeagal apex.

*Distribution.*—(Fig. 47). Southern India (Karnataka, Tamil Nadu). Other than the type series, specimens! collected in Karnataka at Shimoga, Sandur, Kadur, Dharwar, Chikmagalur, Mercara, Ramandrug, and in Tamil Nadu at Tanjore in the Nilgiri Hills, at Kodiakanal, and at Salem. These specimens are not considered as part of the type series because they exhibit a certain amount of variation (refer to geographic variation) from specimens at the type locality. Specimens from Tamil Nadu are closest morphologically to those from the type locality, but are not placed in the type series because of their geographic separation.

*Ecology.*—Adults are found on scrub forest floor from April to July but are most common during May and June.

*Etymology.*—This species name is feminine, genitive singular and derived from the Greek *dasi* (hairy or shaggy) and the suffix *-odes* (resemblance) with reference to the sparsely setose thoracic pleura.

### *Cicindela (Jansenia) semisetigerosa*, new species

*Diagnosis.*—Distinguished by shiny, darkened elytra possessing two lateral maculae; rough and uneven elytral surface sculpturing; elytra with two irregular and sparse rows of large metallic blue-green foveae contrasting with the dark discal surface; dorsal half of proepisterna with very wavy pattern of impressed wrinkles; apical hook on male aedeagus short, abruptly recurved, lying against apex and flattened in cross section; female mesepisternal coupling sulcus a dimple or shallow depression medially.

*Description.*—*General habitus.* (Fig. 11). Body small (8.5–10 mm); head and pronotum shiny copper dorsally, blue-green laterally; elytra shiny black, middle with copper streaks; elytral surface very rough and unevenly contoured with blue-green foveae in two irregular rows on either side of medial longitudinal ridge with two lateral spots; body shiny blue-green and purple (some specimens copper-green) ventrally. *Head.* Mandibles of each sex symmetrical with three teeth distad basal molar, and male mandibles with most of the surface ivory with only teeth darkened, whereas female mandibles with basal half of surface ivory, remainder darkened; labrum long, nonmetallic testaceous, surface mostly smooth with anterior edge medially and anterior portion of medial carina darkened; broad medial carina; 6 to 8 setae originating from large metallic setigerous punctures, mostly submarginal, a few on anterior portion of the medial carina; female with one medial labral tooth; male labrum lacking teeth, anterior margin shallowly concave; penultimate segment of labial palpi dilated, nonmetallic, terminal segment small, shiny black; frons with coarse rugae, transverse at middle and vertical at sides; vertex with very coarse wavy rugae, those adjoining eyes widest, parallel, becoming wavy toward



Fig. 11.—*Cicindela (Jansenia) semisetigerosa*, new species, male holotype from Peechi, Trichur District, Kerala, India. (Body size, 8.8 mm.)

middle, those at extreme middle narrowest and very irregular; surface entirely glabrous except for two pairs of supraorbital setae. *Prothorax*. Pronotum with surface finely and densely scabrous from irregular, wavy ridges on disc and parallel grooves laterally, on most specimens glabrous, on a few specimens with one or two scattered setae at anterolateral angle; proepisterna on most males with medium setigerous punctures (on some males punctures large) covering ventral one-third to half; proepisterna on most females setose only along ventral margin (on some females over ventral one-third); proepisterna on dorsal half with a very wavy pattern of impressed wrinkles about as deep as parallel grooves at lateral edge of pronotum; prosternum glabrous, surface transversely wrinkled. *Pterothorax*. Mesepisterna with wavy wrinkles, glabrous with a few appressed setae at posteroventral edge; female mesepisternal coupling sulcus a medial dimple or shallow depression. *Elytra*. Elytral surface very rough and unevenly contoured, especially on disc, where two narrow longitudinal furrows create abruptly raised and irregular ridges on basal two-thirds, and numerous, very irregular, coarsely raised areas occur mostly on apical third; elytral disc shiny black, middle often streaked longitudinally with copper, punctures deep and dense only on basal half, becoming shallow and sparse apically, smooth and polished at extreme base; disc with two irregular and sparse rows of large metallic blue-green foveae contrasting with dark surface, subsutural row more numerous, medial row more irregular and sparser, generally aligned with a tightly packed group of foveae in depression at inner humeral angle; lateral margin shiny and diffuse iridescent copper and blue-green with purple at extreme edge; two elytral maculae present at lateral margin, anterior one at middle on most specimens smaller, nearly reaching purple iridescence, posterior one larger and situated at outer apical margin; elytral apex truncated, more so on female than male, with small distinct microsculptulations, and a small sutural spine. *Abdomen*. Sterna nearly glabrous except for sparse appressed setae laterally on anterior five sterna on female and all six on male. *Legs*. Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora metallic copper dorsally and black-green ventrally, except for an abruptly separated testaceous distal end; tibiae testaceous with sooty black distal end; tarsomeres dull black to shiny greenish black. *Male genitalia*. Aedeagus moderately bulky, widest at middle with a long, gradually and uniformly tapering apical third; apical tip displaced to the right side in left lateral aspect; short apical hook abruptly recurved at a sharp acute angle to the left side in left lateral aspect; recurved section 0.3 mm long, lying against apex and flattened in cross section.

*Body size*.—*Holotype*. Body length 8.8 mm, elytral width 2.8 mm. *Allotype*. body length 9.8 mm, elytral width 3.6 mm.

*Type locality*.—Peechi, Trichur District, Kerala, India.

*Type specimens*.—*Holotype*, male, labelled "INDIA: Kerala, Trichur District, Peechi, V.1979, T.R.S. Nathan, leg.; Acciavatti, Collection" [handprinted]; "HOLOTYPE, *Cicindela*, semisetigerosa, Acciavatti &, Pearson" [typed and handprinted red label]. Allotypic female and 23 paratypes labelled similarly to holotype. Additional 92 paratypes labelled as follows: "India: Kerala, 20 km E Palghat, 18.VI.1983; forest path"; "India: Kerala, 20 km N. Trichur, 20.VI.1983; forest path"; "India: Kerala, 25 km E Chalakudi, 80 m, 20.V.1985; forest path"; "India: Tamil Nadu, 25 km W Coimbatore, 18.VI.1983; old field"; "India: Tamil Nadu, Pollachi, 19.VI.1983; forest path"; "India: Tamil Nadu, Anamalai (*sic*) Hills, Topslip, 770 m, V.1977"; "India: Anamalai (*sic*) Hills, Cinchona, 770 m, V.1977."

*Type depository*.—*Holotype*, allotype and 9 paratypes at CMNH; 106 remaining paratypes distributed as follows: 66 to DLPC; 9 to JWC; 6 to HBC; 5 each to NMNH, and RLHC; 4 to FCC; 2 each to HSC, DEI, BMNH, IARI and WDSC; 1 to KWVC.

*Distribution*.—(Fig. 48). Southern India (Kerala, western Tamil Nadu).

*Ecology*.—Adults occur along forest paths during May and June.

*Etymology*.—This feminine name is singular and derived by combining the Latin *semi* (half), *set* (bristle), *ger* (to bear) with the suffix *-osa* (full of) with respect to the numerous setigerous punctures on most specimens present only on the lower half of the proepisterna.

***Cicindela (Jansenia) vestiplicatica*, new species**

*Diagnosis*.—Distinguished by the shiny darkened elytra with two (one on a few specimens) lateral maculae; roughened elytral surface; elytra with sparse subsutural

row of metallic foveae; dorsal half of proepisterna moderately impressed wavy wrinkles about as deep as parallel grooves at lateral edge of pronotum; apical hook of male aedeagus broad, gradually recurved and moderately long; female mesepisternal coupling sulcus wrinkled with a small shallow circular depression medially.

*Description.*—*General habitus.* (Fig. 12). Body small (8.0–9.5 mm); head and pronotum bright copper dorsally, copper to copper-green laterally; elytra shiny, copper-black on disc, laterally with a wide, diffuse copper band and a narrow, bluish green edge, surface very rough and unevenly contoured, maculae as two lateral spots, often joined along lateral margin; body shiny purplish black to metallic blue-green ventrally. *Head.* Mandibles of each sex asymmetrical, right mandible with three teeth distad basal molar, left mandible with minute fourth tooth just beyond basal molar; male mandibles mostly ivory, teeth darkened; female mandibles ivory on basal half, remainder darkened; labrum long, non-metallic testaceous on most specimens; medial carina broad; anterior edge of medial carina darkened, slightly metallic on some specimens; eight to ten setae originating from large metallic setigerous punctures, mostly submarginal with only a few on anterior portion of the medial carina; female labrum with one medial tooth; male labrum lacking teeth, anterior margin truncated; penultimate segment of labial palpi dilated, nonmetallic, terminal segment small and black; frons with a pattern of coarse, parallel rugae, lateral rugae longitudinal, medial rugae transverse and extending onto vertex; vertex with very coarse rugae, those adjoining eyes largest, parallel and wavy, those at middle smaller, irregular, slightly transverse; surface entirely glabrous except for two pairs of supraorbital setal. *Prothorax.* Pronotum with surface very finely scabrous from irregular, wavy ridges, and deeply impressed parallel grooves at lateral edge, almost entirely glabrous except for one to several setae at extreme anterolateral angle; proepisterna with large setigerous punctures covering at least ventral half and more often ventral three-quarters of surface on both sexes, surface dull with moderately impressed wavy wrinkles over its dorsal half and parallel grooves at dorsal edge; prosternum glabrous, surface transversely wrinkled. *Pterothorax.* Mesepisterna glabrous with a distinctly wrinkled surface and sparsely setose only at extreme posteroventral margin; female mesepisternal surface slightly wrinkled, coupling sulcus a small shallow circular depression medially. *Elytra.* Surface rough and unevenly contoured, especially on disc, where two narrow, longitudinal furrows create abruptly raised and irregular ridges on basal two-thirds, and numerous, very irregular, coarsely raised areas mostly on apical third; disc shiny copper-black, laterally wide and diffuse metallic copper band and a narrow bluish green edge; punctures deep and dense on basal half, shallow and sparse apically; a few punctures joining at a few places basally to form short transverse grooves impinging upon the narrow sutural ridge creating slight depressions along it; surface smooth and polished at extreme base; large metallic blue-green foveae contrasting with dark surface forming an irregularly spaced and arranged subsutural row and a short row within depression at inner humeral angle (on a few specimens with one foveae medially); elytral maculae varied; most specimens as two lateral spots, small anterior one at middle (absent on some specimens), large one at outer apical angle; on some specimens spots joined along lateral margin; elytral apex truncated, more so on female than male; moderately large microsculptulations; small sutural spine. *Abdomen.* Moderately setose laterally on anterior five sterna on female and all six on male. *Legs.* Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora metallic copper dorsally and black-green ventrally, except for an abruptly separated testaceous distal end; tibiae testaceous with sooty black distal end; tarsomeres dull black to shiny greenish black. *Male genitalia.* Aedeagus very bulky, widest at middle third, moderately elongate and bulky, thickened neck narrowing abruptly just before apex; moderately long apical hook broadly rounded and gradually recurved; recurved section 0.3 mm long, slightly concave in cross section, not lying against apex.

*Body size.*—*Holotype.* Body length 8.5 mm, elytral width 2.9 mm. *Allotype.* body length 9.5 mm, elytral width 3.7 mm.

*Type locality.*—Kumili, Madurai District, Tamil Nadu, India.

*Type specimens.*—Holotype, male, labelled “INDIA: Tamil Nadu, Madurai District, Kumili, 2500 ft, VI.1986, T.R.S. Nathan”; “HOLOTYPE, Cicindela, vestiplicatica, Acciavatti &, Pearson” [typed and handprinted red label]. Allotype, female, four paratypes labelled same as holotype. Two paratypes labelled “INDIA: Kerala, 20 km W Shencottah, 27.V.1986, K.D. Ghorpade; forest path.”

*Type depository.*—Holotype, allotype and two paratypes at CMNH; two paratypes to HBC; one paratype each to DLPC and NMNH.

*Distribution.*—(Fig. 48). Southwestern Tamil Nadu and southern Kerala, India.





Fig. 12.—*Cicindela (Jansenia) vestiplicatica*, new species, male holotype from Kumili, Madurai District, Tamil Nadu, India. (Body size, 8.5 mm.)

*Ecology.*—Habitat details are unrecorded but adults have been collected along forest paths.

*Etymology.*—This species name is feminine singular and derived from the Latin *vestiplica* (laundress) and the suffix *-tica* (belonging to) with reference to the roughened elytral disc appearing like a laundry wash board.

*Remarks.*—Adults of this species closely resemble *C. corticata* in general body

appearance; however, they differ in details of elytral surface sculpturing and shape of the male genitalic apical hook.

*Cicindela (Jansenia) legnotia*, new species

*Diagnosis.*—Distinguished by the shiny darkened elytra with two lateral maculae; proepisterna moderately impressed with wavy wrinkles over most of its surface; elytral surface sculpturing slightly uneven, forming only a broad longitudinal ridge regular in width basally; male aedeagal apical hook abruptly recurved, very long and flattened; female mesepisternal coupling sulcus a moderately wrinkled surface with medial depression either very shallow or absent.

*Description.*—*General habitus.* (Fig. 13). Body small (8.5–10 mm); head and pronotum dorsally shiny copper, laterally copper-green; elytra dorsally uniformly dull copper to copper-black, surface slightly unevenly contoured, two lateral spots, one at middle, one at outer apical angle; body shiny metallic blue-green and purple ventrally. *Head.* Mandibles of each sex asymmetrical, right mandible with three teeth distad basal molar, minute fourth tooth on left mandible just beyond basal molar; male mandibles mostly ivory, only teeth darkened; female mandibles ivory on basal half, remainder darkened; labrum long, testaceous and nonmetallic, smooth; anterior margin and edge of medial carina darkened; broad medial carina; seven to nine setae originating from large metallic setigerous punctures, mostly submarginal, a few on anterior portion of medial carina; one large medial tooth on female labrum; male lacking teeth, anterior margin evenly rounded; penultimate segment of labial palpi dilated, nonmetallic, terminal segment small and shiny black; frons with coarse, transverse and wavy rugae; vertex with very coarse wavy rugae, those adjoining eyes wavy and parallel, those at middle smaller and irregular, slightly transverse; surface entirely glabrous except for two pairs of supraorbital setae. *Prothorax.* Pronotal surface very finely scabrous, disc with irregular wavy ridges, deeply impressed parallel grooves at lateral edge; pronotum glabrous on female, sparse setae at anterolateral angle on male; proepisternal surface dull, uneven, coarsely wrinkled, except for parallel grooves along dorsal margin about as coarse as rugae at lateral edge of pronotum; sparse, erect setae originating from small setigerous punctures over most of male pronotal surface, only on ventral half of female; prosternum glabrous, surface transversely wrinkled. *Pterothorax.* Mesepisterna uneven, dull, surface distinctly wrinkled, glabrous except for a few setae near posteroventral margin; female mesepisternal coupling sulcus a small, medial depression either very shallow or absent. *Elytra.* Elytral surface slightly unevenly contoured on disc, uniformly broad longitudinal ridge on basal two-thirds, on some specimens slightly raised areas apically; elytral disc uniformly dull copper to copper-black except for a broad diffuse shiny copper to copper-green lateral margin and a narrow blue-green and purple lateral edge; elytral surface with large, deep, dense punctures only on basal half, becoming distinctly smaller, shallower and sparser apically; on some specimens a few punctures join at several places basally on the disc to form short grooves impinging upon narrow sutural ridge to create no more than a few slight depressions along it; elytra smooth and polished at extreme base; metallic blue-green foveae large and distinct, contrasting with copper surface, forming an irregular subsutural row (on some specimens one or two foveae medially near apical end), several foveae occur within depression at inner humeral angle; two elytral spots at lateral margin, anterior one at middle small, posterior one large and situated at outer apical angle; elytral apex truncated, more so on female than male; micro-serrulations small; sutural spine small. *Abdomen.* Moderate numbers of appressed setae laterally, fewer numbers medially on anterior five sterna on both sexes, and at extreme lateral margin on sixth sternum on male. *Legs.* Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora metallic copper dorsally and black-green ventrally, except for an abruptly separated testaceous distal end; tibiae testaceous with sooty black distal end; tarsomeres dull sooty black. *Male genitalia.* Aedeagus moderately bulky, very wide on middle third, apical third narrower and nearly of uniform width; apex acutely rounded; apical hook long and narrow, abruptly bent back at a sharp acute angle; recurved section 0.45 mm long, very flattened in cross section, lying very close to apex basally but separated from apex distally.

*Body size.*—*Holotype.* Body length 8.8 mm, elytral width 3.1 mm. *Allotype.* Body length 10.0 mm, elytral width 3.9 mm.

*Type locality.*—Tope, Madurai District, Tamil Nadu, India.

*Type specimens.*—Holotype, male, labelled "INDIA: Tamil Nadu, Tope (350 m), 21.IX.1986, T. Shivashankar; scrub forest"; "HOLOTYPE, *Cicindela*, *legnotia*,



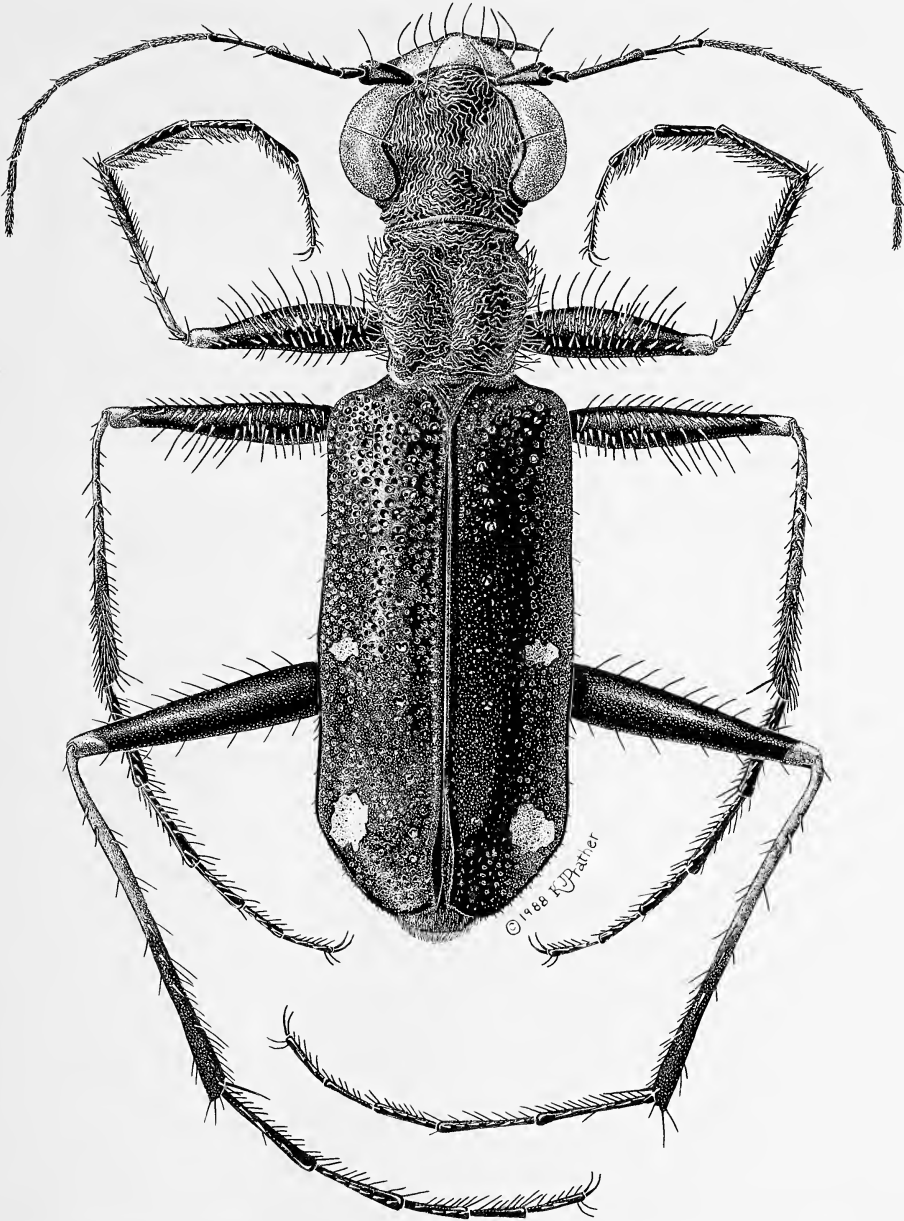


Fig. 13—*Cicindela (Jansenia) legnotia*, new species, male holotype from Tope, Madurai District, Tamil Nadu, India. (Body size, 8.8 mm.)

Acciavatti & Pearson” [typed and handprinted red label]. Allotypic female and nine paratypes labelled similar to holotype. Four additional paratypes from the type locality labelled, “Tope, Foot of Palni Hills, S. India, 20–23.IX.1922, S. Kemp.” Two additional paratypes from “India, Tamil Nadu, Coimbatore, 1400 ft,” one collected IX.1977, the other X.1972.

*Type depository.*—Holotype, allotype and 2 paratypes to NMNH; 13 remaining paratypes distributed as follows: 6 to ZSI; 2 to DLPC; 2 to CMNH; 1 each to FCC, IARI and WDSC.

*Distribution.*—(Fig. 49). Western Tamil Nadu, India.

*Ecology.*—Adults occur on the floor of scrub forests during September.

*Etymology.*—This species name is feminine singular and derived from the Greek *legnotos* (with a colored border) with reference to the labrum in both sexes being narrowly darkened along its entire anterior border and a more widely darkened medial area extending onto medial carina.

*Cicindela (Jansenia) plagatima*, new species

*Diagnosis.*—Distinguished by the shiny, darkened elytra with two lateral maculae; slightly unevenly contoured elytral sculpturing with longitudinal copper streaks; apical hook of male aedeagus gradually recurved, short and thickened; female mesepisternal coupling sulcus a very small, shallow circular dimple medially.

*Description.*—*General habitus.* (Fig. 14). Body small (8.5–9.5 mm); head and pronotum dorsally shiny copper, laterally copper-green; elytra dorsally shiny black along longitudinal ridge at middle and on a broad subsutural band, and copper or copper-green at lateral margin, in a streak along line of metallic blue-green foveae, and along suture; elytral surface slightly unevenly contoured with two lateral spots; body ventrally shiny metallic blue-green and purple. *Head.* Mandibles of each sex asymmetrical, right mandible with three teeth distad basal molar, left mandible with a very small fourth tooth just beyond basal molar, and male mandibles with most of the surface ivory with only teeth darkened, whereas female mandibles with entire basal half ivory, remainder darkened; labrum long, nonmetallic, most of its surface smooth, testaceous except for darkened anterior margin and edge of broad medial carina; seven to ten setae originating from large metallic setigerous punctures, mostly submarginal with a few on anterior portion of the medial carina, female with one large, medial tooth, male lacking teeth with anterior margin slightly concave; penultimate segment of labial palpi dilated, nonmetallic, terminal segment small and shiny black; frons with coarse transverse and wavy rugae; vertex with very coarse wavy rugae, those adjoining eyes wavy and parallel, those at middle irregular, arcuate or slightly transverse; surface entirely glabrous except for two pairs of supraorbital setae. *Prothorax.* Pronotum with surface very finely scabrous, disc with irregular wavy ridges, lateral edge with deeply impressed parallel grooves, glabrous on both sexes; proepisterna dorsally with wrinkled surface distinctly shallower than at lateral edge of pronotum and extending only to middle where erect setae originating from large setigerous punctures occupy ventral half on each sex; prosternum glabrous, surface transversely wrinkled. *Pterothorax.* Mesepisterna smooth or with very shallow wrinkled surface; female mesepisternal coupling sulcus a very small, shallow circular dimple medially. *Elytra.* Elytral surface slightly unevenly contoured; disc with a broad longitudinal ridge, uniformly wide on basal two-thirds; some specimens also with slightly raised areas apically; elytral disc partially shiny black, contrasting along longitudinal ridge with a broad copper or copper-green lateral margin; disc interrupted by a narrow copper or copper-green streak lying between the broad black longitudinal ridge and a broad black subsutural band; suture copper; elytral surface with large, deep, dense punctures only on basal half, becoming distinctly smaller, shallower and sparser apically; on a few specimens some punctures join at several places basally on the disc to form short grooves impinging upon sutural ridge creating no more than a few slight depressions along it; elytra smooth and polished at extreme base; large metallic foveae, contrasting with copper surface, forming a subsutural row irregular in spacing and arrangement (on some specimens one or two foveae occur slightly mesad of others), with several foveae within depression at inner humeral angle; two elytral maculae present at lateral margin, anterior one at middle on most specimens smaller, posterior one larger (short apical extension on some specimens) and situated at outer apical margin; elytral apex truncated, more so on female than male, with small distinct microsculptulations, and a small sutural spine. *Abdomen.* Sterna with moderate amounts of appressed setae laterally on anterior five on female and on all six sterna on male; sterna almost entirely glabrous medially on both sexes. *Legs.* Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora metallic copper dorsally, black-green ventrally, except for an abruptly separated testaceous distal end; tibiae testaceous with sooty black distal end; tarsomeres dull sooty black. *Male genitalia.* Aedeagus moderately bulky, widest at middle, long thickened apical third, ending in a very bulky and broadly rounded apex; apical hook gradually recurved to the left

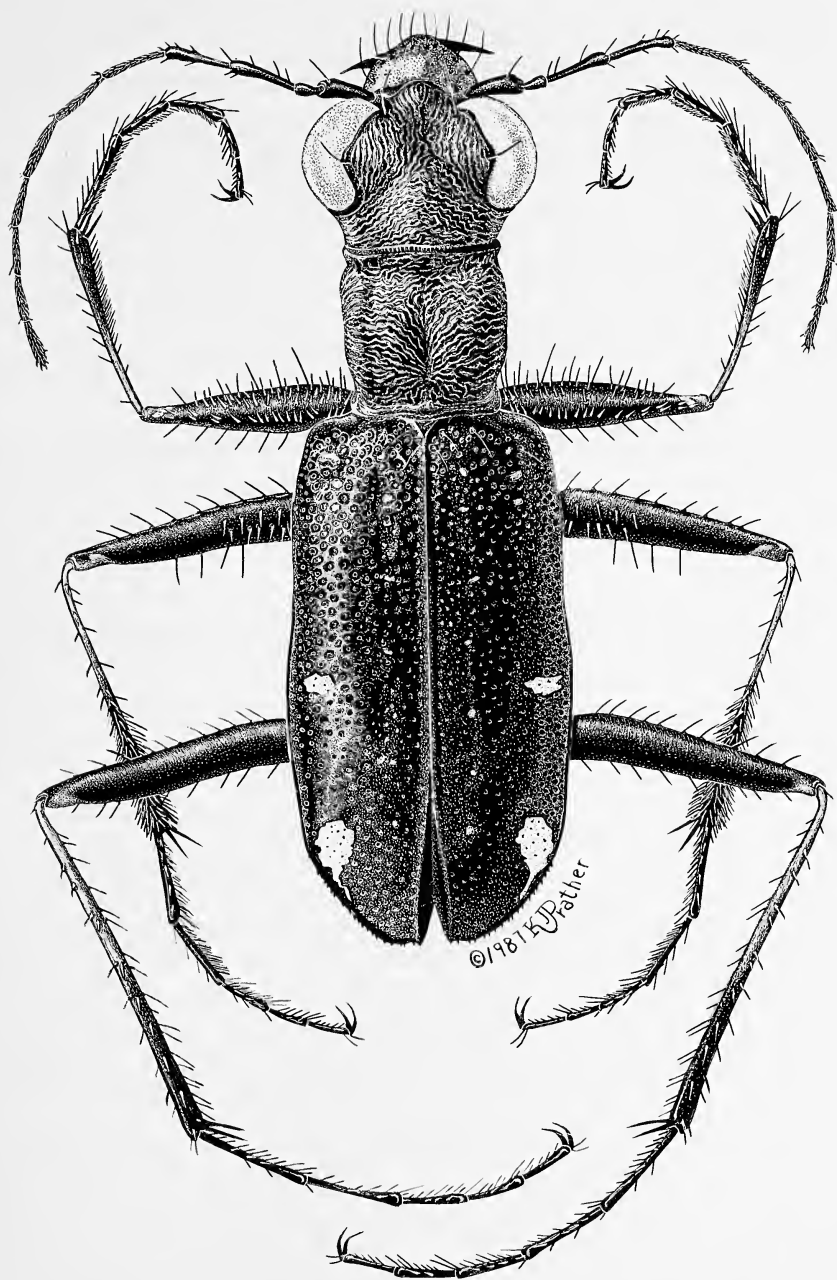


Fig. 14.—*Cicindela (Jansenia) plagatima*, new species, male holotype from Salem, Salem District, Tamil Nadu, India. (Body size, 8.6 mm.)

side in left lateral aspect, recurved section 0.3 mm long, thickened at base, slightly concave in cross section, tapering abruptly and not lying against apex.

*Body size.*—*Holotype*. Body length 8.6 mm, elytral width 2.8 mm. *Allotype*. Body length 9.5 mm, elytral width 3.4 mm.

*Type locality.*—Salem, Salem District, Tamil Nadu, India.

*Type specimens.*—*Holotype*, male, labelled "INDIA: Tamil Nadu, 15 km N. Salem, 660 m, 26.VI.1984, D.L. Pearson; scrub forest floor"; "HOLOTYPE, *Cicindela*, plagatima, Acciavatti & Pearson" [typed and handprinted red label]. Female allotype, three paratypes labelled same as holotype. An additional 58 paratypes from the type locality but collected from June through September during 1985 and 1986.

*Type depository.*—*Holotype* and one paratype at IARI; allotype and 5 paratypes to NMNH; 55 remaining paratypes distributed as follows: 49 paratypes to DLPC; 4 to CMNH; 1 each to UASC and ZSI.

*Distribution.*—(Fig. 48). Southern India (north central Tamil Nadu, southern Andhra Pradesh, eastern Kerala). In addition to the type series, specimens! at UASB have been collected in Tamil Nadu in the Pachamalai Hills and Palni Hills in scrub forest habitats during late September. A single specimen! at ZSI was collected from the Palkonda Hills in southern Andhra Pradesh. A specimen! at JWC from Tenmalai, Quilon District, Kerala, India, is tentatively assigned to this species.

*Ecology.*—Adults are found on the floor of scrub forests from June through September.

*Etymology.*—Feminine singular in gender, this name is derived from the Latin *plagat* (streaked) and *-ima* (a superlative suffix) with reference to the longitudinal, copper streaks laterally and medially on each elytron.

### *Cicindela (Jansenia) ostrina*, new species

*Diagnosis.*—Distinguished by the shiny, darkened elytra with two lateral maculae; broad, longitudinal ridge on elytra uniformly wide on basal two-thirds with a slightly raised area apically; apical hook on male aedeagus gradually rounded, broadly recurved, short and thickened; female mesepisternal surface wrinkled.

*Description.*—*General habitus.* (Fig. 15). Body small (8.5–9.5 mm); head and pronotum dorsally shiny copper with two small blue-green areas between eyes, laterally blue-green; elytra dorsally uniformly shiny black, laterally with a broad copper or copper-green band and a broad purple margin, surface slightly unevenly contoured on disc with a broad, longitudinal ridge regular in width on basal two-thirds and with a slightly raised area apically, laterally with two spots; body shiny metallic blue-green and purple ventrally. *Head*. Mandibles of each sex asymmetrical distad basal molar; right male mandible three-toothed; right female mandible three-toothed, minute acute bulge on basal shoulder of first tooth; small fourth tooth on left mandible just beyond basal molar on both sexes; male mandibles mostly ivory, teeth darkened; female mandibles ivory on entire basal half, remainder darkened; labrum long, nonmetallic testaceous, anterior edge of medial carina only slightly darkened on male; medial carina broad, mostly smooth; five to eight setae originating from large metallic setigerous punctures, mostly submarginal with only a few on anterior portion of the medial carina, female with one medial tooth, male lacking teeth with anterior margin truncated; penultimate segment of labial palpi dilated, nonmetallic, terminal segment small, shiny black; wavy rugae on frons coarse, transverse and vertical; vertex with very coarse rugae, those adjoining eyes parallel, becoming wavy medially and irregular, slightly transverse at center; surface entirely glabrous except for two pairs of supraorbital setae. *Prothorax*. Pronotum entirely glabrous, discal surface coarsely scabrous from irregular, wavy ridges, lateral margin with deeply impressed, transversely parallel ridges; proepisterna with very shallow parallel wrinkles confined to dorsal margin, and distinctly shallower than moderately impressed parallel rugae at lateral edge of pronotum; proepisterna dorsally glabrous with setae originating from large setigerous punctures on ventral half on male, only near ventral margin on female; prosternum glabrous and

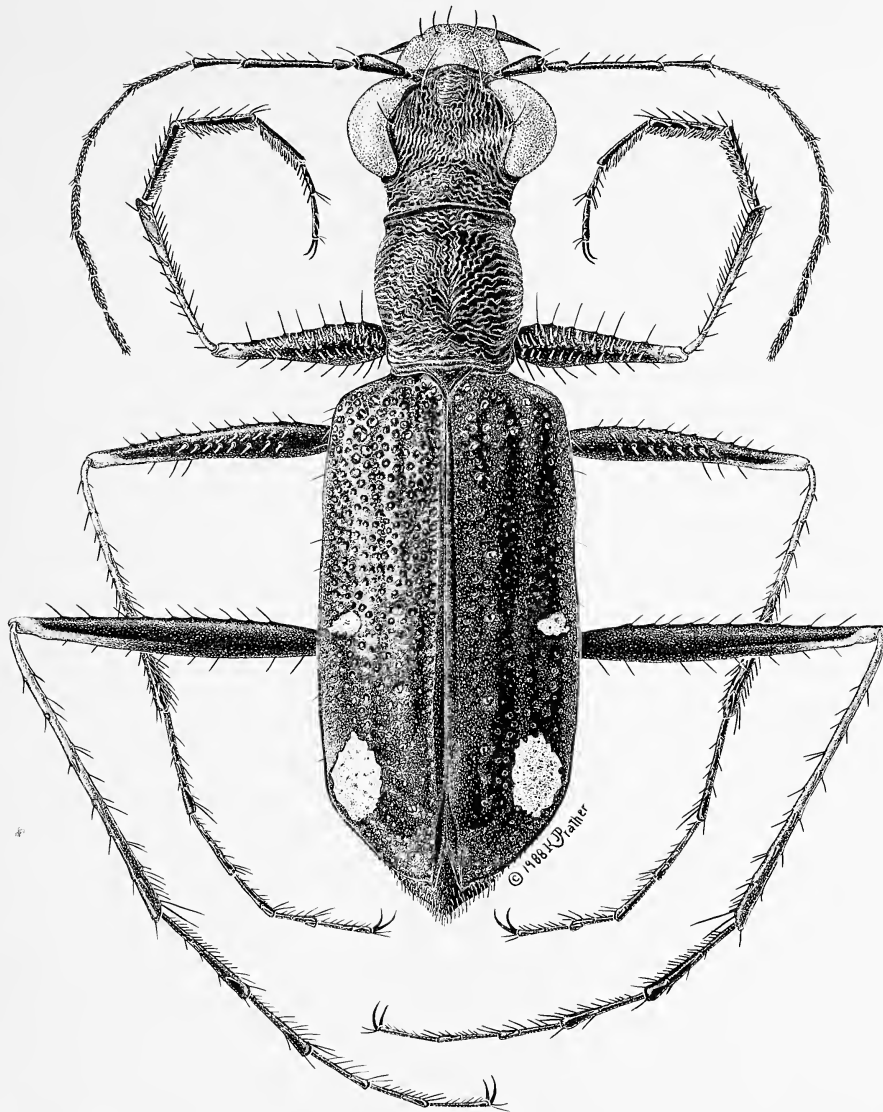


Fig. 15.—*Cicindela (Jansenia) ostrina*, new species, male holotype from Waltair, Visakhapatnam District, Andhra Pradesh, India. (Body size, 8.6 mm.)

transversely wrinkled. *Pterothorax*. Mesepisterna with a slightly wrinkled surface, glabrous except for a few scattered setae at posteroventral margin; female mesepisternal coupling sulcus a small, shallow circular dimple medially. *Elytra*. Elytral disc uniformly shiny black, laterally with a broad copper or copper-green lateral band and a broad purple margin, suture black; elytral surface slightly unevenly contoured on disc with a broad, longitudinal ridge regular in width on basal two-thirds and with slightly raised area apically; elytra laterally with two spots, one at middle very small, one at outer apical angle very large and oval; surface with large, deep, dense punctures mainly on basal half gradually becoming smaller, shallower and sparser apically, smooth and polished at extreme base; a subsutural row of large metallic foveae, and several in depression at inner humeral angle, contrasting with dark surface; elytral apex truncated, more so on female than male; small microserrulations; small sutural spine. *Abdomen*. Female with sparse, appressed setae only laterally on anterior four sterna (glabrous

medially and on fifth sternum), male with lateral setae on anterior five sterna, and at margin on sixth (all glabrous medially). *Legs*. Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora metallic copper dorsally and black-green ventrally, except for distal end where the boundary between testaceous and unpigmented portions is poorly defined and widest on posterior surface; tibiae testaceous with sooty black distal end; tarsomeres dull black to shiny greenish black. *Male genitalia*. Aedeagus moderately bulky, widest at middle with apical third broadly and uniformly tapering at apex; broadly rounded hook gradually recurved to the left side in left lateral aspect; recurved section 0.2 mm long, thickened and slightly concave on cross section and not lying against apex.

*Body size*.—*Holotype*. Body length 8.6 mm, elytral width 2.9 mm. *Allotype*. Body length 9.5 mm, elytral width 3.5 mm.

*Type locality*.—Waltair, Visakhapatnam District, Andhra Pradesh, India.

*Type specimens*.—*Holotype*, male, labelled "INDIA: A.P., 30 km N Waltair, 27.VI.1986 (100 m), D.L. Pearson; scrub forest"; "HOLOTYPE, *Cicindela*, ostrina, Acciavatti & Pearson" [typed and handprinted red label]. Female allotype, 13 paratypes with same label data as holotype. Thirty-one additional paratypes labelled: "INDIA: A.P., 20 km N Waltair, 20.VI.1986, 550 m, D.L. Pearson; scrub forest"; "INDIA: A.P., 65 km N Waltair, 29.VI.1986, D.L. Pearson; scrub forest"; "INDIA: A.P., 57 km NW Hyderabad, 4.VII.1986, D.L. Pearson; scrub forest"; "INDIA: A.P., 11 km W Marsipatnam, 28.VI.1986, D.L. Pearson; scrub forest"; "INDIA: A.P., 15 km N Salur, 30.VI.1986, D.L. Pearson; scrub forest"; "INDIA: A.P., 10 km E Salur, 30.VI.1986, D.L. Pearson; scrub forest"; "INDIA: A.P., 30 km E Warangal, 5.VII.1986, D.L. Pearson; scrub forest"; "INDIA: A.P., 60 km NW Tuni, 1.VII.1986, D.L. Pearson; scrub forest."

*Type depository*.—*Holotype*, allotype and 5 paratypes to NMNH; 39 remaining paratypes distributed as follows: 33 to DLPC; 2 to CMNH; 1 each to ZSI, IARI and UASB.

*Distribution*.—(Fig. 49). Central and eastern Andhra Pradesh, India.

*Ecology*.—Adults are active during June and July within scrub forests. This species is found together with the superficially similar *Cicindela tetrastacta* at elevations above 500 m.

*Etymology*.—This feminine singular name is derived from the Latin *ostrina* (purple) with respect to the wide, purple lateral margin of the elytra.

*Remarks*.—This species is most similar to *Cicindela plagatima* from which it can be separated by its uniformly shiny black elytral disc, broad purple margin, black suture, and distal end of femora with the boundary between testaceous and unpigmented portions poorly defined on posterior surface.

### *Cicindela (Jansenia) corrugatosa*, new species

*Diagnosis*.—Distinguished by the shiny darkened elytra with two lateral maculae; elytra evenly contoured lacking any surface irregularities; abdomen nearly glabrous; male aedeagal apical hook abruptly recurved at a shallow acute angle, recurved section long, very flat and lying against a membranous portion of the apex; female mesepisternal coupling sulcus coarsely wrinkled, medial depression broad, medial dimple shallow on most females, obscure on others.

*Description*.—*General habitus*. (Fig. 16). Body small (8.5–10 mm); head and pronotum dorsally shiny copper with two small blue-green areas between eyes, laterally blue-green or bronze; elytra dorsally shiny black on most specimens, a diffuse bronze lateral margin and a narrow blue-green and purple edge on some specimens; elytral surface evenly contoured, disc entirely lacking any irregularities; two small oval spots laterally; body shiny purple-green ventrally. *Head*. Mandibles of each sex asymmetrical, right mandible with three large, acute teeth distad basal molar (on a few male specimens a minute fourth tooth lies adjacent to molar), left mandible with minute fourth tooth distad basal molar; male mandibles mostly ivory, only teeth darkened; female mandibles entire basal half ivory, remainder

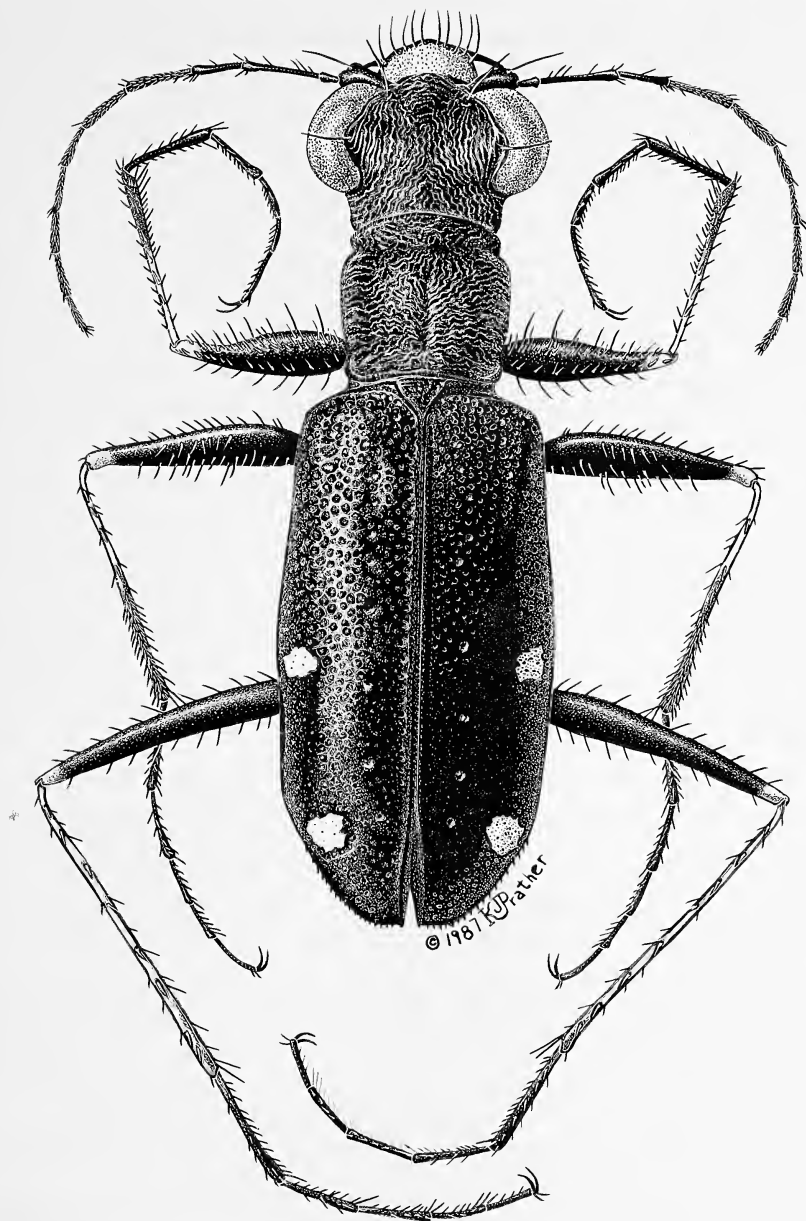


Fig. 16.—*Cicindela (Jansenia) corrugatosa*, new species, male holotype from Coimbatore, Coimbatore District, Tamil Nadu, India. (Body size, 8.5 mm.)

darkened; labrum long, nonmetallic, abruptly raised medial carina, most of the surface smooth and testaceous, on some specimens with anterior edge of medial carina darkened; 8 to 11 setae originating from large metallic setigerous punctures, mostly submarginal with several at anterior portion of the medial carina; female with one medial tooth, male lacking teeth; broad bulge at anterior margin on some specimens, broadly rounded on others; penultimate segment of labial palpi dilated, nonmetallic, terminal segment small and dark brown to black; frons with coarse, parallel rugae, aligned vertically laterally and transversely to arcuate medially; vertex with coarse wavy rugae, those adjoining eyes



wavy and parallel, those at middle irregular, slightly transverse; surface entirely glabrous except for two pairs of supraorbital setae. *Prothorax*. Pronotum with surface very coarsely scabrous from irregular, wavy ridges on disc, laterally with deeply impressed parallel rugae; pronotal surface entirely glabrous; proepisternal surface covered with deeply impressed wrinkles forming a distinct, wavy pattern on both sexes; proepisterna with sparse semierect setae originating from small setigerous punctures most numerous on ventral half and only on a few specimens on dorsal half on male, only along ventral margin on female; prosternum glabrous, surface with wavy, transverse wrinkles. *Pterothorax*. Mesepisterna entirely glabrous on female, a few setae at posteroventral margin on male; female mesepisterna covered by moderately impressed, wavy wrinkles; coupling sulcus a broad, shallow, medial depression, either with or without a shallow, medial dimple; metepisterna with moderately impressed wavy rugae, almost entirely glabrous on female, covered with sparse, semierect setae on male. *Elytra*. Elytra evenly contoured without any longitudinal ridges medially on the disc either basally or apically; elytral disc with deep, dense punctures only on basal half, punctures gradually becoming shallow and sparse apically, smooth and polished at extreme base; large metallic foveae contrasting with black elytral surface, arranged in a subsutural row and in depression at inner humeral angle; two small oval spots near lateral margin, spot at middle on most specimens smallest, spot at outer apical angle slightly larger; dorsally shiny black, laterally diffuse shiny bronze margins gradually merging with color on disc, narrow blue-green and purple lateral edge not reaching the humeral angle; elytral apex truncated, more so on female than male; small microsculptulations; small sutural spine. *Abdomen*. Sterna entirely glabrous on female, only very sparsely setose on male; numerous longitudinal rugae laterally on first two sterna on both sexes. *Legs*. Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora opaque, dark metallic copper-black or greenish black throughout the entire length on all surfaces, except for obvious short, testaceous portion at distal end which abruptly contrasts with remainder of length on all surfaces; tibiae testaceous with sooty black distal end; tarsomeres dull black. *Male genitalia*. Aedeagus moderately bulky, widest at middle, very broadly tapering to a broad apex and displaced to the right side in left lateral aspect; apical hook abruptly recurved at a shallow acute angle to the left side in left lateral aspect; recurved section extending for 0.45 mm long, very flat and lying against a membranous portion of the apex basally, but not touching apex distally.

*Body size*.—*Holotype*. Body length 8.5 mm, elytral width 2.7 mm. *Allotype*. Body length 9.8 mm, elytral width 3.0 mm.

*Type locality*.—Coimbatore, Coimbatore District, Tamil Nadu, India.

*Type specimens*.—*Holotype*, male, labelled "SOUTH INDIA: Madras, Coimbatore, 1400 ft, IX.1973, T.R.S. Nathan, leg."; "HOLOTYPE, *Cicindela*, *corrugatosa*, Acciavatti &, Pearson" [typed and handprinted red label]. Female allotype, three paratypes labelled same as holotype. Additional 50 paratypes from the type locality except taken during September through December between 1932 and 1977.

*Type depository*.—*Holotype*, allotype and 9 paratypes at CMNH; 44 remaining paratypes distributed as follows: 10 to WDSC; 7 to FCC; 6 to AMNH; 5 to RDWC; 3 to RMC; 2 each to JWC, RLHC, HSC, and DEI; 1 each IARI, ZSI, DLPC, NMNH, and BMNH.

*Distribution*.—(Fig. 47). Southern India (northwestern Tamil Nadu).

*Ecology*.—The habitat is unrecorded but adults most likely occur in open scrub forests and have been collected from September to December.

*Etymology*.—Feminine singular name derived by combining the Latin *corrugatus* (wrinkled) and the suffix *-osa* (full of) with reference to the wavy pattern of shallow, surface wrinkles dorsally on the proepisterna.

### *Cicindela (Jansenia) cratera*, new species

*Diagnosis*.—Distinguished by the partially pale, translucent femora; presence of moderate to abundant amounts of setae on thoracic sclerites; larger body size; smooth elytral sculpturing, uniformly large and distinct elytral punctation; two large elytral spots broadly touching the lateral margin, posterior one extended



apically; apical hook of male aedeagus wide and gradually recurved at a broad angle, recurved section short, wide and concave in cross section.

*Description.*—*General habitus.* (Fig. 17). Body small to medium (9–10.5 mm); head and pronotum dorsally shiny copper with broad, bronze-green areas laterally; elytra evenly contoured, lacking longitudinal ridges; nearly uniform distribution of large distinct punctures; copper to bronze on disc, laterally broad and diffuse metallic copper-green, narrow purple edge; two large, lateral spots broadly touching and extended along lateral margin; body metallic bronze, green and purple ventrally. *Head.* Mandibles differently asymmetrical on each sex; right mandible of male tridentate distad basal molar, left mandible with minute fourth tooth just beyond basal molar, right mandible of female with four large, acute teeth distad basal molar but left mandible with a very small fourth tooth near basal molar; male mandibles with most of the surface ivory with only teeth darkened, whereas female mandibles with entire basal half ivory, remainder darkened; labrum long, nonmetallic mostly smooth, testaceous with anterior edge of medial carina on some specimens darkened; broad medial carina; 8 to 11 labral setae originating from large metallic setigerous punctures, mostly submarginal, a few on anterior portion of medial carina; one medial tooth on female labrum; male labrum lacking teeth, anterior margin truncated, on a few specimens a short, blunt medial projection; penultimate segment of labial palpi dilated, nonmetallic, terminal segment small dark brown; frons coarsely rugose, rugae vertically aligned laterally, wavy and transverse to arcuate medially; vertex with very coarse wavy rugae, those adjoining eyes nearly parallel, those at middle very irregular and slightly transverse; surface entirely glabrous except for two pairs of supraorbital setae. *Prothorax.* Pronotal surface very coarsely scabrous from irregular, wavy ridges on disc and parallel transverse grooves laterally, often with several to many setae at anterolateral angle on male, entirely glabrous on female; proepisternal surface bronze-green, covered with moderately impressed wrinkles forming a distinct, wavy pattern on both sexes; proepisterna with sparse semierect setae originating from small setigerous punctures most numerous on ventral half and only on a few specimens on dorsal half on male, only along ventral margin on female; prosternum glabrous, except for several setae anterior to coxae, surface transversely wrinkled. *Pterothorax.* Mesepisterna metallic copper-green with abundant, appressed setae covering surface on male, over ventral half on female; female mesepisterna smooth, only slightly wrinkled; coupling sulcus a small shallow circular pit medially. *Elytra.* Elytral surface very evenly contoured without any longitudinal ridges medially on the disc either basally or apically; disc copper to bronze, laterally with a broad copper margin, and a narrower blue-green and violet edge, all reaching the humeral angle, and diffuse shiny margins gradually merging with color on disc; elytral punctures large, deep and distinct, not grouped into shallow depressions, only slightly shallower and sparser apically, surface smooth and polished at extreme base; numerous metallic blue-green foveae contrasting with dark surface, situated both medially, in subsutural row, and a short row in depression at inner humeral angle; two large spots, broadly touching lateral margin, anterior spot elongate and posterior spot oblong with distinct, often long, apical extension; elytra of female distinctly broader on apical half; elytral apex truncated, more so on female than on male; small distinct microsculptulations; sutural spine small. *Abdomen.* Anterior five abdominal sterna on female, all six on male, laterally covered with moderate amounts of long, appressed setae. *Legs.* Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora pale testaceous, distinct metallic reflections in certain lighting on dorsal and lateral surfaces, diffuse testaceous color of short distal portion extending along posteroventral surface; tibiae testaceous with pale brown distal end; tarsomeres pale brown. *Male genitalia.* Aedeagus extremely bulky and widest at several places on middle half, apical fourth tapering uniformly and broadly to a large, gradually rounded apex; apical hook wide and gradually recurved at a broad angle; recurved section 0.25 mm long, concave in cross section and extending away from apex.

*Body size.*—*Holotype.* Body length 9.1 mm, elytral width 3.0 mm. *Allotype.* Body length 10.1 mm, elytral width 3.5 mm.

*Type locality.*—Kovilpatti, Tirunelveli District, Tamil Nadu, India.

*Type specimens.*—Holotype, male, labelled “20 & 21.X.’18, Koilpatti, Tinnevely, C.N. Coll.” [typeset]; “HOLOTYPE, Cicindela, cratera, Acciavatti & Pearson” [typed and handprinted red label]. Female allotype, two paratypes labelled similar to holotype. [Almost certainly the type series came from Kovilpatti, Tirunelveli District; the holotype label locality being a transliteration into English from the Tamil.]

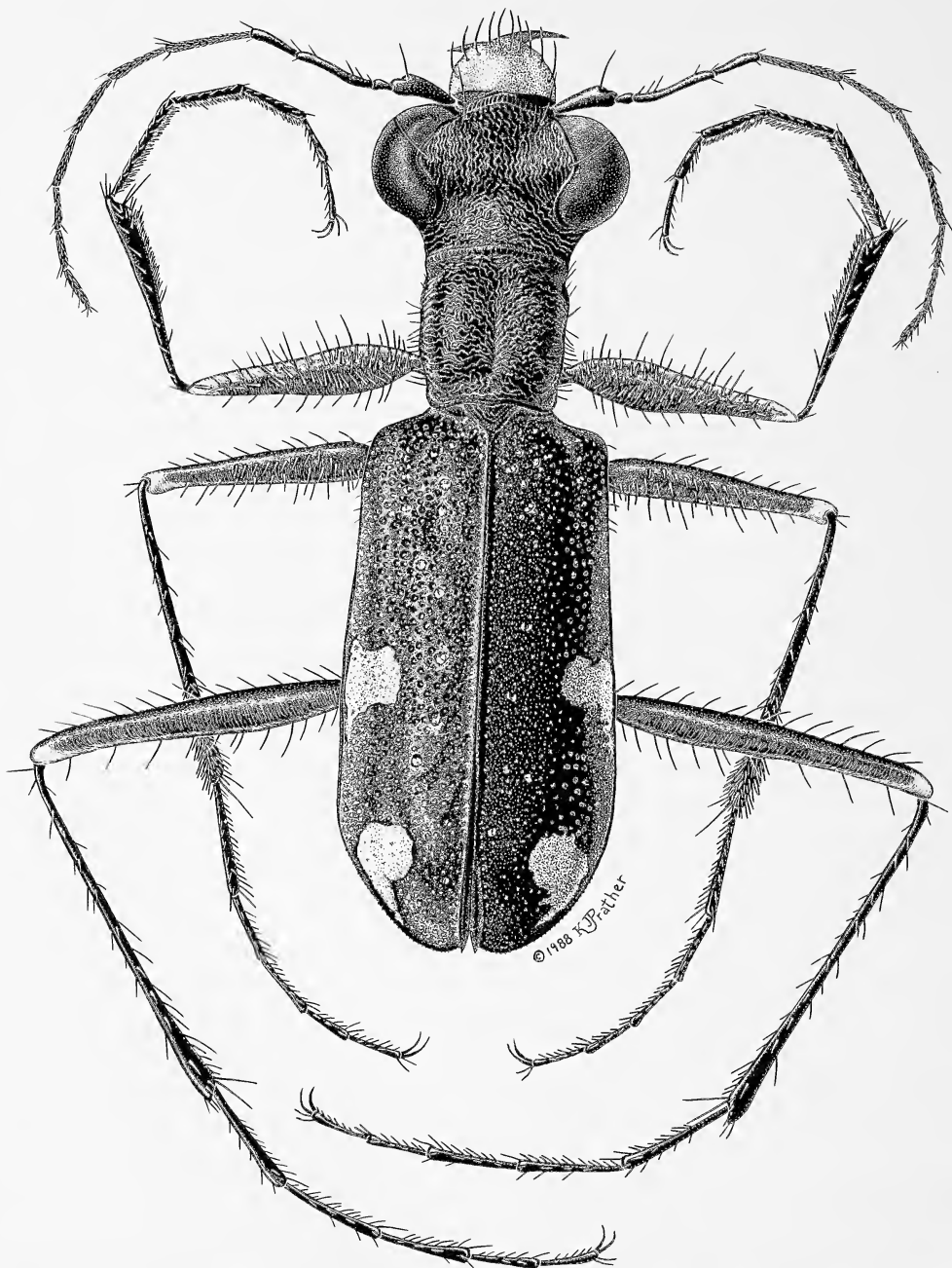


Fig. 17.—*Cicindela (Jansenia) cratera*, new species, male holotype from Kovilpatti, Tirunelveli District, Tamil Nadu, India. (Body size, 9.1 mm.)

*Type depository.*—Holotype and allotype to NMNH; 1 paratype each to DLPC and CMNH.

*Distribution.*—(Fig. 56). Known only from the type locality in southwestern Tamil Nadu, India.

*Ecology.*—The habitat preference is unreported but adults occur during October and probably frequent scrub forests like related species.

*Etymology.*—This species name is feminine singular and derived from the Latin *cratera* (pitted) with reference to the elytral surface which is covered with deep, dense punctures.

*Cicindela (Jansenia) cirrhidia*, new species

*Diagnosis.*—Distinguished by the two broad lateral elytral spots; testaceous femora; diffuse shiny lateral elytral margins; evenly contoured elytral surface; deep, dense elytral punctures; sparse lateral thoracic setae; female mesepisterna smooth; coupling sulcus a small shallow medial pit; male aedeagus noticeably narrower just before apex, apical hook shallowly recurved, recurved section long and slender.

*Description.*—*General habitus.* (Fig. 18). Body small (8–10 mm); head and pronotum dorsally shiny copper to copper-green; elytral surface evenly contoured on disc; elytral maculae as two large, lateral spots, one at middle, one at outer apical angle, both nearly touching lateral edge; body shiny metallic blue-green and purple ventrally. *Head.* Mandibles symmetrical on male, three large teeth distad basal molar; asymmetrical on female, three large teeth distad basal molar, right mandible with minute fourth tooth on largest tooth near basal molar; male mandibles mostly ivory, only teeth darkened; female mandibles entirely ivory on basal half, remainder darkened; labrum long, nonmetallic, with a broad medial carina, most of its surface smooth, testaceous except for anterior edge of medial carina which is slightly metallic on male, but entirely testaceous on female, six to ten submarginal setae originating from large metallic setigerous punctures, mostly submarginal with a few on anterior portion of the medial carina, female with one medial tooth, male lacking teeth with anterior margin truncated; penultimate segment of labial palpi dilated, nonmetallic, terminal segment small, dark brown; frons with coarse, transverse and wavy rugae; vertex with very coarse wavy rugae of equal size from eyes to middle, rugae irregular and slightly transverse medially; surface glabrous except for two pairs of supraorbital setae. *Prothorax.* Pronotal surface finely scabrous from irregular wavy ridges and deeply impressed transversely parallel grooves at lateral margin; pronotum glabrous on both sexes; proepisterna with large setigerous punctures covering ventral three-quarters of surface on male, but only near ventral margin on female, surface with coarse wavy wrinkles on male, shallower wrinkles on female except at dorsal edge with coarser wrinkles; prosternum glabrous, except for a few setae anterior to coxae, surface transversely wrinkled. *Pterothorax.* Mesepisterna glabrous, few setae at posteroventral margin on some specimens; female mesepisterna mostly smooth, coupling sulcus a very small, shallow circular depression medially. *Elytra.* Elytral surface evenly contoured on disc; surface entirely lacking any irregularities or boldly contrasting colors, rather elytra lateral edge narrowly blue-green ending before humeral angle; diffuse shiny copper margins merging gradually with remainder of surface color; elytral disc with deep, dense punctures, shallower and sparser only near apex, surface smooth and polished at extreme base; elytra with numerous metallic blue-green foveae medially, in subsutural row and several in depression at inner humeral angle, all contrasting with darker surface; lateral margin diffuse metallic green to copper; elytral maculae large, broadly touching lateral margin; anterior spot elongate; posterior spot oblong, short apical extension present; elytral apex truncated, more so on female than male; microsculptulations small; sutural spine small. *Abdomen.* Sterna with sparse, appressed setae laterally on anterior five on female, on all six on male. *Legs.* Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora translucent, pale and testaceous throughout their entire length on all surfaces; testaceous tibiae light brown at distal end; tarsomeres dull brown. *Male genitalia.* Aedeagus moderately bulky, widest in middle third, broadly tapering in apical third, noticeably narrowed just before apex; apical hook slender, shallowly recurved to the left side in left lateral aspect; recurved segment 0.35 mm, narrow and semicircular in cross section.

*Body size.*—*Holotype.* Body length 8.7 mm, elytral width 2.8 mm. *Allotype.* Body length 9.5 mm, elytral width 3.1 mm.

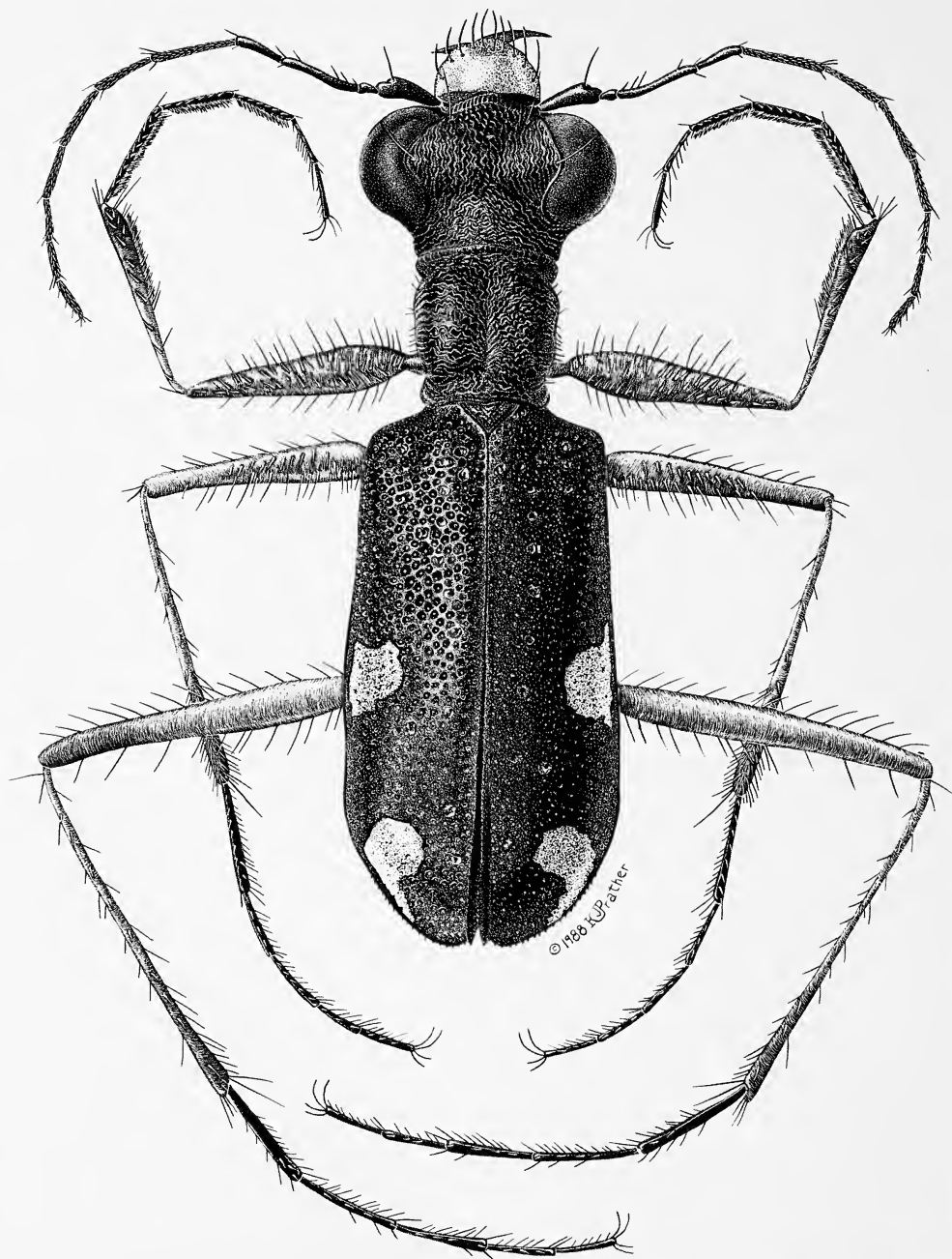


Fig. 18.—*Cicindela (Jansenia) cirrhidia*, new species, male holotype from Kokmotte, Wilpattu National Park, Mannar District, Sri Lanka. (Body size, 8.7 mm.)

*Type locality.*—Kokmotte, Wilpattu National Park, Mannar District, Sri Lanka.

*Type specimens.*—Holotype, male, labelled “SRI LANKA, Man. Dist., 0.5 mi NE Kokmotte, Wilpattu Nat'l. Park, 50 to 100 ft, 5–8.X.1977, at white light; P.B. Karunaratne, P. Fernaldo, T. Wijesinhe, M. Jayaweera, K.V. Krombein”; “HOLOTYPE, Cicindela, cirrhidia, Acciavatti & Pearson” [typed and handprinted red label]. Allotypic female, two paratypes labelled the same as the holotype. One paratype labelled “SRI LANKA, Mannar District, Wilpattu National Park, 0.5 mi N.E. Cockmuttai, 20 m, 6, 7.X.1977.” One paratype from “Sri Lanka, Anuradhapura, 24.XI.1980.” Five additional paratypes from “Sri Lanka, Jaffna District, 13 miles south of Pooneryn, near 100 ft elevation, 7.XI.1976.”

*Type depository.*—Holotype and 6 paratypes at NMNH; allotype and 2 paratypes to CMNH; 1 paratype to RLHC.

*Distribution.*—(Fig. 47). Northern part of Sri Lanka (Anuradhapura, Mannar and Jaffna districts).

*Ecology.*—The habitat is unreported but adults probably frequent scrub forests like those of related species.

*Etymology.*—This feminine singular name is derived from the Greek *cirrho* (tawny) and *-idia* (diminutive suffix) with respect to the overall pale, testaceous appearance of the legs.

### *Cicindela (Jansenia) stellata*, new species

*Diagnosis.*—Distinguished by the shiny, darkened elytra possessing two lateral maculae which broadly touch margin; legs lacking all or most pigmentation; diffuse shiny lateral elytral margins; evenly contoured elytral surface with deep, dense elytral punctation; female mesepisterna wrinkled, lacking a distinct medial pit; apex of male aedeagus uniformly broadened to tip, apical hook slightly and acutely recurved, recurved segment very short and narrow.

*Description.*—*General habitus.* (Fig. 19). Body small (8.5–10 mm); head and pronotum shiny, dorsally copper to copper-red with two small blue-green areas between eyes, laterally bronze-green; elytra copper to copper-black on disc with a broad, diffuse shiny and copper lateral margin and a narrow blue-green and purple edge, surface evenly contoured on disc with two large, lateral spots nearly touching lateral edge; body shiny metallic blue-green and purple ventrally. *Head.* Mandibles asymmetrical on each sex, right mandible distad basal molar with three teeth, minute fourth tooth on left mandible near basal molar; male mandibles mostly ivory, only teeth darkened; female mandibles entirely ivory on basal half, remainder darkened; labrum long, nonmetallic; broad medial carina; labral surface smooth, basal portion testaceous with a broad, darkened anterior edge extending onto anterior portion of medial carina; six to ten setae originating from large metallic setigerous punctures, most submarginal, a few on anterior portion of the medial carina; female labrum unidentate; male labrum lacking teeth, anterior margin truncated; penultimate segment of labial palpi dilated, nonmetallic; terminal segment small, black; frons with coarse, wavy rugae, vertical laterally, transverse and arcuate medially; vertex with very coarse wavy rugae, parallel and larger adjacent to eyes, less coarse toward middle where rugae become irregular and slightly transverse; surface glabrous except for two pairs of supraorbital setae. *Prothorax.* Pronotal surface very coarsely scabrous from irregular, wavy ridges on disc and transversely parallel grooves at lateral margin; pronotum glabrous on both sexes; proepisterna with large setigerous punctures covering ventral three-quarters of surface on male, but only on ventral half on female; surface with moderately impressed wavy wrinkles at middle, shallower ventrally; dorsal edge with coarse, parallel grooves meeting deeply impressed parallel grooves at lateral edge of pronotum; prosternum glabrous, surface transversely wrinkled. *Pterothorax.* Mesepisterna coarsely wrinkled, glabrous or with a few setae at posteroventral margin; female mesepisternal coupling sulcus a very small, shallow circular depression medially. *Elytra.* Elytral surface evenly contoured on disc, the surface lacking any irregularities or boldly contrasting colors; elytra disc copper to copper-black; broad shiny copper lateral margins and narrow blue-green and purple edge absent from humeral angle; diffuse shiny copper margins and discal surface color gradually merging; elytral disc with large, deep, dense

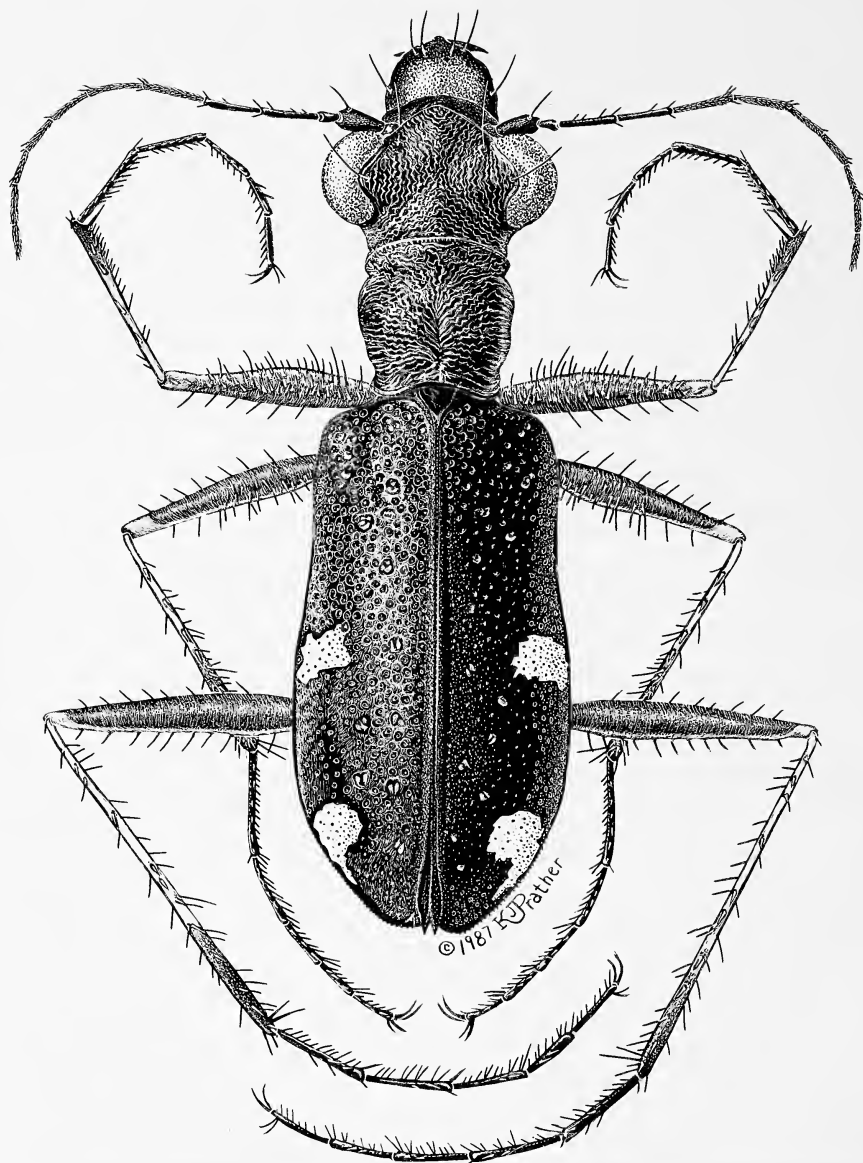


Fig. 19.—*Cicindela (Jansenia) stellata*, new species, female holotype from Trincomalee, China Bay, Trincomalee District, Sri Lanka. (Body size, 9.7 mm.)

punctures gradually shallower and sparser apically, maintaining their distinctiveness; surface smooth and polished at extreme base; elytra with numerous metallic blue-green foveae medially on apical third, in irregular subsutural row and in depression at inner humeral angle; foveae contrast with darker surface; elytral maculae large, broadly touching lateral margin; anterior spot elongate and posterior spot oblong, short apical extension present; female elytra widest on apical third; elytral apex truncated, more so on female than on male; small microserrulations; sutural spine small. *Abdomen*. Sterna with moderate amounts of appressed setae laterally on anterior five on both sexes and with a fringe of setae laterally on sixth on male; sterna medially glabrous. *Legs*. Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora partially pale and testaceous in certain lighting with



a distinct metallic shine on dorsal or lateral surfaces, distal end with a short, but diffuse testaceous portion extending along posteroventral surface; tibiae testaceous with light brown distal end; tarsomeres dull brown. *Male genitalia*. Aedeagus moderately bulky, widest in middle third, tapering uniformly and broadly to a blunt apex displaced to the right side in left lateral aspect; apical hook recurved at a slight acute angle to left side in left lateral aspect; recurved segment 0.13 mm long and narrow.

*Body size*.—*Holotype*. Body length 9.7 mm, elytral width 3.2 mm. *Allotype*. Body length 8.5 mm, elytral width 2.8 mm.

*Type locality*.—Trincomalee, China Bay, Trincomalee District, Sri Lanka.

*Type specimens*.—*Holotype*, female, labelled "SRI LANKA: Tri. Dist., Trincomalee, China Bay, 0 to 30 m., 8 to 11.X.1977; collected near ridge bungalow, K.V. Krombein, P.B. Karunaratne, P. Fernando, T. Wijesinhe, M. Jayaweera"; "HOLOTYPE, *Cicindela*, *stellata*, Acciavatti & Pearson" [typed and handprinted red label]. Allotypic male, one female paratype with same collection data.

*Type depository*.—*Holotype* and female paratype at NMNH; male allotype to CMNH.

*Distribution*.—(Fig. 48). Known only from the type locality on the northeast coast of Sri Lanka (Trincomalee District).

*Ecology*.—The habitat is unreported but adults are probably associated with scrub forests like those of related species.

*Etymology*.—This species name is feminine singular and derived from the Latin *stellata* (set with stars) and refers to the numerous brilliant metallic foveae mesad apically on each elytron.

### *Cicindela (Jansenia) laeticolor* Horn, new rank

*Cicindela corticata laeticolor* Horn, 1904:36.

*Type status*. Syntypes (one male, two females) in original description [unexamined; concept based on male specimen! at NMNH labelled "Ceylon; S.P., Hambantota, T.B.F., 7.NOV.08" [first three lines typeset, last handprinted]; "WICKHAM, Collection, 1933" [typeset]; "Cic. corticata, laeticolor, W.H., Dr. W. Horn det 1935" [first three lines and numeral '5' in date manuscript by Walther Horn, remainder typeset]; "Cicindela, laeticolor W. Horn, det. R.E. Acciavatti, 1983" [typeset]]. *Type depository*. Unrecorded; not at DEI (Döbler, 1973). *Type locality*. "Ceylon" (Sri Lanka).

*Cicindela corticata laticolor (sic)* Horn: Heynes-Wood and Dover, 1928:75.

*Diagnosis*.—Distinguished by the shiny darkened elytra; two oval lateral elytral spots not touching lateral edge; irregular row of subsutural metallic green foveae; glabrous mesepisterna; entirely pale testaceous femora and tibiae; apical hook of male aedeagus short, thickened and gradually recurved.

*Description*.—*General habitus*. Body small (9–10 mm); head and pronotum dorsally shiny copper and purple, laterally shiny blue-green; elytra dull bronze on disc and diffuse metallic copper laterally with a narrow blue-green and purple margin, marked with two circular spots nearly equal in size and located at lateral margin on apical half; body purple and purplish green ventrally. *Head*. Male mandibles distad basal molar each with four teeth (fourth minute), mostly ivory except for darkened teeth; labrum long, nonmetallic testaceous except darkened at anterior margin and edge of medial carina; medial carina abrupt; six to eight setae originating submarginally from large metallic setigerous punctures; male labrum lacking teeth, anterior margin broadly rounded; penultimate segment of labial palpi dilated, nonmetallic, terminal segment small and dark brown; frons with coarse, arcuate rugae extending onto vertex as very irregular and wavy rugae except nearly parallel adjoining eyes; frons, vertex and genae glabrous. *Prothorax*. Pronotum coarsely scabrous from irregular, wavy ridges on disc; rugae forming moderately deep parallel grooves at lateral margin; very sparsely setose at middle of lateral margin and anterior lateral angle; proepisterna covered with large setigerous punctures on male, dorsal edge very smooth, no more than shallow parallel grooves meeting deeply impressed parallel grooves at lateral edge of pronotum; prosternum glabrous, surface transversely wrinkled.

*Pterothorax*. Male mesepisterna glabrous except for a few setae at extreme posteroventral margin, surface shallowly wrinkled. *Elytra*. Surface evenly contoured; elytral disc dull bronze, diffuse metallic copper laterally; narrow blue-green and purple margin with large dense punctures on basal half, abruptly smaller and sparser in vicinity of anterior spot, smooth and polished at extreme base; irregular subsutural row of metallic green foveae and a short row of many foveae in depression at inner humeral angle, contrasting with dark surface of disc; two circular spots coequal in size located near but not touching lateral margin on apical half; elytral apex truncated; microsculptulations small; sutural spine small. *Abdomen*. Anterior five sterna on male each with lateral areas of sparse, appressed setae, sixth sternum only fringed by setae at lateral edge. *Legs*. Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora and tibiae translucent testaceous except for sooty black distal end; tarsomeres brownish black, slightly metallic tinged. *Male genitalia*. Aedeagus very bulky, widest in middle third, very broadly and uniformly tapering in apical third, abruptly narrowed just before apex; apical hook short, thick, gradually recurved; recurved section 0.2 mm long, uniformly tapered and semicircular in cross section.

*Distribution*.—(Fig. 48). Southern Sri Lanka (Hambantota District).

*Localities*.—SRI LANKA: Hambantota District: Hambantota, 31.X.1908, 7.XI.1908 (NMNH).

*Ecology*.—Habitat is unreported; adults most likely occur in scrub forests.

*Remarks*.—*Cicindela laeticolor* should be separated from *Cicindela corticata* because adult males of each species differ by the shape of the apical hook on the aedeagus, elytral punctuation and leg pigmentation.

*Cicindela (Jansenia) chorioidista*, new species

*Diagnosis*.—Distinguished by the two lateral elytral maculae; pale translucent femora and tibiae; shiny copper to copper-green elytra; wrinkled and setose mesepisterna; abruptly recurved apical hook of the male aedeagus.

*Description*.—*General habitus*. (Fig. 20). Body small to medium (8.5–10.5 mm); head and pronotum shiny copper and purple dorsally, shiny copper to bronze laterally; elytral disc shiny, bright copper to copper-green, on some specimens green reflections dominate; elytra diffuse metallic copper laterally, on some specimens margin narrow blue-green; two circular elytral spots nearly equal in size at lateral margin on apical half; body copper, blue-green and purple-green ventrally. *Head*. Mandibles on each sex asymmetrical distad basal molar, three right teeth, four left teeth; anterior surface ivory on male except for darkened teeth, only basal half ivory on female, remainder darkened; labrum long, covering most of mandible; medial carina abrupt; labral surface smooth, uniformly pale without anterior margin darkened; six to eight setae originating submarginally from large metallic setigerous punctures; female labrum with one large tooth medially; male labrum lacking teeth, anterior margin truncated and slightly indented at middle; penultimate segment of labial palpi dilated, nonmetallic, terminal segment small and dark brown; frons coarsely rugose, rugae vertical laterally, wavy and slightly transverse medially; rugae forming a pattern of wavy and nearly parallel ridges from eyes to vertex midline; vertex glabrous. *Prothorax*. Pronotal surface coarsely scabrous due to irregular wavy ridges on disc and moderately deep, transverse parallel grooves at lateral margin; pronotum sparsely setose at anterolateral angle on male, glabrous on female; proepisterna with large setigerous punctures, sparser on female than male, setae on some specimens only on ventral third; parallel wrinkles on dorsal surface moderately impressed laterally, wavy wrinkles shallowly impressed medially becoming smooth at posteroventral margin; prosternum transversely wrinkled, glabrous on female, sparsely setose anterior to procoxae on male. *Pterothorax*. Mesepisterna slightly wrinkled, sparsely setose on male, glabrous on female except for a few setae at extreme posteroventral margin; female mesepisternal coupling sulcus a small, circular depression medially. *Elytra*. Surface evenly contoured; disc shiny, bright copper to copper-green, green reflections dominate on some specimens; diffuse metallic copper laterally, narrow green margins on some specimens; sutural ridge copper; large, dense punctures on basal half of disc, gradually smaller and sparser near anterior spot; basal area smooth and polished; metallic green to copper foveae forming irregular subsutural row and short row in depression at inner humeral angle; foveae on most specimens not contrasting with dark surface of disc basally; two circular spots of nearly equal size, one at middle, the other at the outer apical angle near but not at lateral margin; elytral apex truncated, more so on female than male; microsculptulations small; sutural spine small. *Abdomen*. Sparse appressed setae laterally on anterior five female sterna, on all male sterna. *Legs*. Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora entirely testaceous and translucent, slightly metallic green tinged; tibiae testaceous with sooty black distal end;



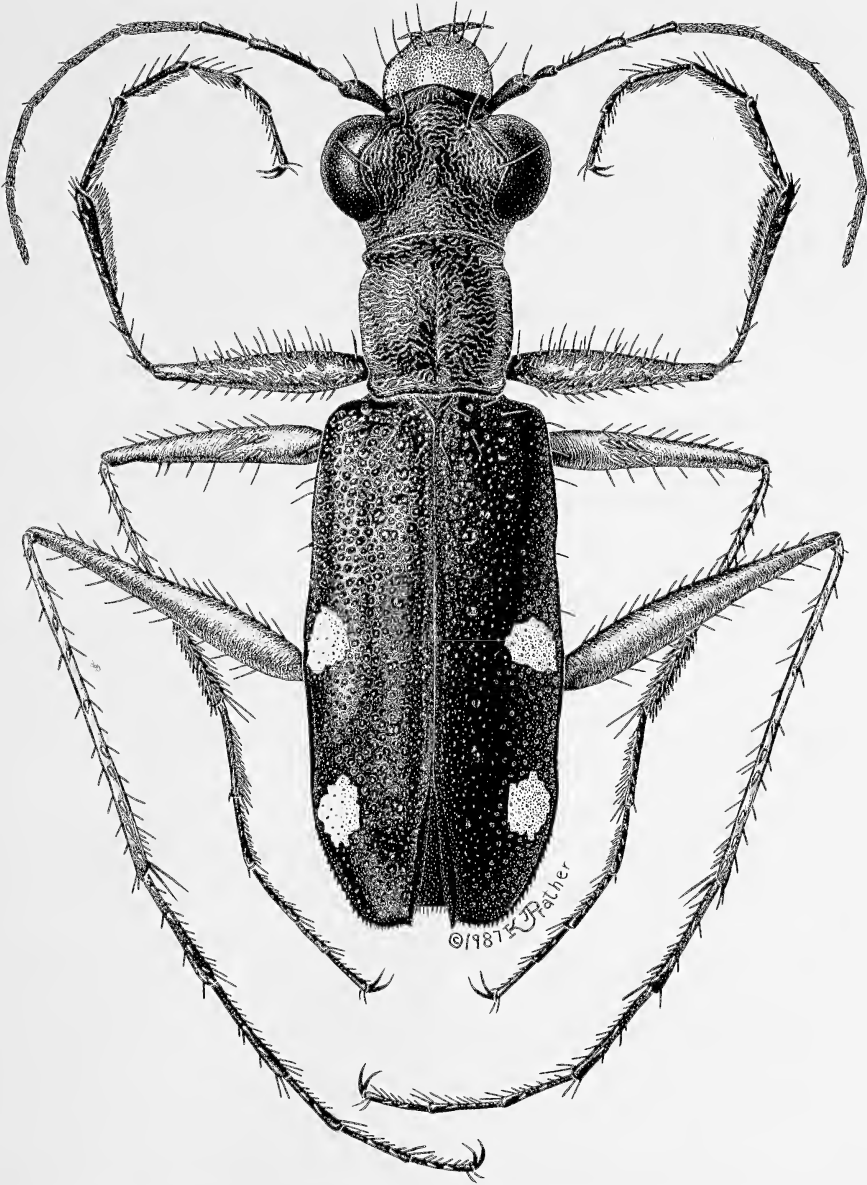


Fig. 20.—*Cicindela (Jansenia) choriodista*, new species, male holotype from Pudukkottai, Pudukkottai District, Tamil Nadu, India. (Body size, 8.9 mm.)

tarsomeres testaceous basally, brown distally often metallic green tinged. *Male genitalia*. Aedeagus bulky, widest on middle third, broadly and uniformly tapered on apical third, abruptly narrowed just before apex; hooked apex of aedeagus abruptly curved; recurved section flattened and internally concave in cross section.

*Body size*.—*Holotype*. Body length 8.9 mm, elytral width 2.8 mm. *Allotype*. Body length 10.5 mm, elytral width 3.1 mm.

*Type locality*.—Pudukkottai, Pudukkottai District, Tamil Nadu, India.

*Type specimens*.—Holotype, male, labelled "INDIA: Tamil Nadu, Puduk-

kottai (*sic*) District, Puddukkottai (*sic*), XI.1984" [handprinted]; "HOLOTYPE, Cicindela, choriodista, Acciavatti & Pearson" [typed and handprinted red label]. Female allotype, four paratypes with same label data as holotype; additional 61 paratypes collected either at the type locality or within 27 km of it in scrub forests during September and October in various years between 1973 and 1987.

*Type depository.*—Holotype, allotype and 8 paratypes at CMNH; 57 remaining paratypes distributed as follows: 35 to DLPC; 5 each to NMNH and WDSC; 2 to JWC; 7 to UASB; 1 each to ZSI, IARI and HSC.

*Distribution.*—(Fig. 48). Southern India (Tamil Nadu). In addition to the type series, specimens! at DLPC and UASB have been collected near Madurai, Tamil Nadu, India, during late September in scrub forest habitats.

*Ecology.*—Adults emerge during the late summer and fall monsoons from late September through November and are found on scrub forest floor at elevations of 250 to 300 m.

*Etymology.*—This name is feminine singular and derived from the Greek *chorio* (membrane), *dis* (separate) and *-ta* (a suffix) with reference to the pale, nonmetallic and nearly translucent legs contrasting with the metallic body.

### *Cicindela (Jansenia) prothymoides* Horn

*Cicindela prothymoides* Horn, 1908a:120.

*Type status.* Lectotype, female [here designated]. *Type labels.* "Karkur Ghat-, Malabar" [handscript on two lines]; "Type!, coll. W Horn" [typeset label with black border]; "Syntypus" [typeset red label]; "EBERSWALDE, DEI" [typeset]; "LECTOTYPE, Cicindela, prothymoides W. Horn, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 9 mm.] Paralectotypes, male! at DEI and female! at BMNH, each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository.* Lectotype and paralectotype at DEI; paralectotype at BMNH. *Type locality.* "Karkur Ghat, Malabar" (Kerala, India).

*Jansonia prothymoides* (Horn): Rivalier, 1961:134.

*Diagnosis.*—Distinguished by the absence of maculae; slightly shiny, dark uneven elytra; wide purple lateral elytral margin; absence of apical hook on male aedeagus.

*Description.*—*General habitus.* Body small (8–9 mm); head and pronotum glabrous, dorsally shiny copper-black, laterally shiny blue-green to violet; elytra slightly shiny, immaculate, surface rough, uneven, dorsally black to copper-black, laterally surface smooth with a wide, shiny purple band; body black and purple ventrally. *Head.* Labrum long, nonmetallic, on most specimens testaceous basally, dull, black at anterior edge and along abrupt medial carina, on some specimens black color expanded to cover most of surface; large medial carina on female extends anteriorly into one large tooth at anterior margin; medial carina on male ends at truncated and toothless anterior margin; labrum with eight submarginal setae; penultimate segment of labial palpi testaceous, greatly inflated and broadly joining basal segment, terminal segment dark; medial process of mentum uniformly slender; vertex rugose, numerous parallel rugae laterally, abruptly arcuate rugae forming concentric circles medially; vertex anteriorly concave, meeting frons at an angle; frons finely and transversely rugose. *Prothorax.* Pronotum elongate, nearly parallel sided; pronotal surface glabrous; fine, wavy slightly transverse rugae, more regular where they meet along a thin medial line; anterior transverse sulcus shallow; posterior transverse sulcus only slightly more deeply impressed; proepisterna black, finely wrinkled and glabrous except for a few scattered appressed and erect setae near coxal margin; prosternum glabrous. *Pterothorax.* Covered by scattered appressed and erect setae; female mesepisternal coupling sulcus a shallow, circular pit medially. *Elytra.* Immaculate; dorsally slightly shiny copper-black; surface rough, uneven with dense, moderately deep punctures basally; several punctures often grouped to form short, shallow, transverse depressions; punctures becoming quite small, shallow and widely separated apically; laterally surface smooth, wide shiny purple or purplish black band, mesad of which lies a narrow line of copper-green iridescence, neither band nor line reaching suture apically; apices micro-serrulate, uniformly rounded with a small sutural spine. *Abdomen.* Sterna nearly glabrous except for a few setae laterally on first sternum. *Legs.* Trochanters testaceous, one subapical seta on each front

and middle segment; femora metallic purple and green except for a short, testaceous portion at distal end; tibiae and tarsomeres dull black. *Male genitalia*. Aedeagus short, bulbous, widest at middle, tapering abruptly and uniformly to a short, acute apex lacking a hook.

*Distribution*.—(Fig. 48). Southern part of the Western Ghats in Kerala, Tamil Nadu, and Karnataka, India.

*Localities*.—INDIA: Kerala: Trichur District, Peechi, V.1979 (CMNH, JPC); 20 km N Trichur, 20.VI.1983, forest path (DLPC); 20 km E Palghat, 18.VI.1983, forest path (DLPC); 25 km E Chalakudi, 20.V.1985, forest path (DLPC); Tamil Nadu: Anaimalai Hills, Topslip, 770 m, V.1977 (CMNH, DLPC); Coimbatore, VI.1937 (AMNH); Karnataka: Karka (?Karkal), 4.VI.1987, forest floor (UASB).

*Ecology*.—Adults are found on the open floor of moist forests. This species is not common and usually occurs with the more abundant *Cicindela semisetigerosa*.

### *Cicindela (Jansenia) crassipalpis* Horn

*Cicindela crassipalpis* Horn, 1908b:410.

*Type status*. Lectotype, female [here designated]. *Type labels*. "Podanur, Andrewes, AKWeld Downing" [handscript on folded label]; "Type!, W. Horn" [typeset within a thin black border]; "Cicindela crassipalpis W.H., Dr. W. Horn det 1930" [first line handscript, second typeset]; "Syntypus" [typeset red label]; "EBERSWALDE, DEI" [typeset]; "LECTOTYPE, Cicindela, crassipalpis W. Horn, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 12 mm.] Paralectotypes, male at DEI and male at BMNH, each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository*. Lectotype and paralectotype at DEI; paralectotype at BMNH. *Type locality*. "Potanur, 1000 ft, Coimbatore District" (Podanur, Tamil Nadu, India).

*Cicindela crassipalpis* Horn: Fowler, 1912:332, fig. 148.

*Jansonia crassipalpis* (Horn): Rivalier, 1961:134.

*Diagnosis*.—Distinguished by the three maculae on apical half of elytra.

*Description*.—*General habitus*. Body medium (10–13.5 mm); head and pronotum shiny copper with green and red reflections; elytra with disc black and speckled with copper to blue-green iridescence, laterally with a broad copper to copper-green margin, maculae as three spots on posterior half; ventrally thorax copper-red, abdomen bluish black. *Head*. Mandibles symmetrical on each sex with four large, acute teeth anterior to basal molar, male mandible with anterior surface mostly ivory except for darkened teeth, female mandible with basal half ivory and remainder darkened; labrum of male short, exposing much of each mandible during adduction, anterior edge straight and possessing only a broad, darkened medial bulge, whereas labrum of female long, covering most of each mandible during adduction, anterior edge concave with one, large darkened medial tooth; labrum mostly testaceous with broad and shallow medially raised area and six submarginal setae on each sex; penultimate segment of labial palpi dilated, nonmetallic, terminal segment small with distal half dark brown; frons with moderately large straight rugae, vertical across middle, forming a transverse wedge dorsally; vertex medially with a broad anteriorly sloping depression between eyes; vertex with large, straight rugae forming nearly parallel ridges next to eyes, slightly oblique at middle, finely impressed and forming an irregular wavy pattern behind eyes; rugae on frons straight laterally, transverse and wedge-shaped medially; frons and genae glabrous; vertex glabrous. *Prothorax*. Pronotal surface coarsely rugose with rugae forming an oblique pattern of slightly wavy and straight ridges on each side of medial line, rugae transverse and less raised on lateral third; anterior and posterior transverse sulci broadly impressed; pronotal lateral margins broad, numerous sparse appressed setae originating from small setigerous punctures on both sexes, anterior and posterior margins also sparsely setose on male; propisterna entirely covered with long and dense, appressed setae dorsally directed and originating from small setigerous punctures on both sexes; prosternum glabrous. *Pterothorax*. Mesepisterna with sparse appressed setae on posterior half; female mesepisternal coupling sulcus a narrow, nearly vertical, medial groove. *Elytra*. Elytral disc black; speckled with copper to blue-green iridescence, irregularly distributed punctures largest basally, shallowest apically; subsutural row of shiny green foveae and large, iridescent blotches; elytra broadly iridescent copper to copper-green along lateral margin from humeral to outer apical angle; lateral margin with larger, denser, and deeper punctures than on disc; three spots in a row on posterior half, anterior two at the lateral iridescence, apical one at the lateral margin; anterior spot small and oval, middle one larger with a short anterior projection, apical one largest with a long posterior projection along lateral edge; apex finely microserrulate; sutural spine

small; apical margin slightly truncated at suture. *Abdomen*. Anterior five sterna with moderate appressed setae laterally, remaining surface and sixth sternum glabrous on each sex. *Legs*. Trochanters reddish testaceous, one subapical seta on each front and middle segment; male femora metallic blue-green except at distal end; female femora only partially metallic along anterior edge, posterior edge translucent testaceous; tibiae and tarsomeres pale testaceous except for a black distal band on each segment. *Male genitalia*. Aedeagus large and bulky, conical in shape, widest on basal third, tapering gradually on middle third before tapering abruptly at apex; short broadly rounded apical hook.

*Distribution*.—(Fig. 49). Southern India (western Tamil Nadu, Kerala).

*Localities*.—INDIA: Tamil Nadu: Coimbatore, 430 m, X.1974 (CMNH); Marudamalai Hills, X.1971 (CMNH); 25 km S Pollachi, 19.VI.1983, forest path (DLPC); Kerala: Kottayam District, Peermade, X, XI.1975 (CMNH).

*Ecology*.—Adults occur from June to October on paths through shrubby forested slopes of hills up to 700 m.

### *Cicindela (Jansenia) tetrastacta* Wiedemann

*Cicindela tetrastacta* Wiedemann, 1823:65.

*Type status*. Lectotype, male [here designated]. *Type labels*. "Mus. Westerm." [typeset]; "3" [printed small square]; "Type" [red typeset]; "Bengal, juli 1808, Tetrasticta Wied." [handscript]; "Zool. Museum, DK Copenhagen" [typeset]; "LECTOTYPE, *Cicindela*, tetrastacta Wied., by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 9 mm.] Paralectotype, female [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository*. Lectotype and paralectotype at ZMUC. *Type locality*. "Bengal" (West Bengal, India).

*Cicindela colon* Klug, 1834:11.

*Type status*. Holotype, female [by monotypy; unexamined; synonymy follows Fowler (1912)]. *Type depository*. Unrecorded. *Type locality*. Reportedly unknown in original description.

*Euryoda tetrastacta* (Wiedemann): Fleutiaux, 1890:168.

*Tetreurytarsa tetrastacta* (Wiedemann): Horn, 1892a:94.

*Jansonia tetrastacta* (Wiedemann): Rivalier, 1961:134.

*Diagnosis*.—Distinguished by the shiny, copper-black elytra; two lateral spots on apical half; metallic crimson head and pronotum; elytra with wide iridescent violet, blue, green and red lateral margins; males with the proximal second and third tarsomeres of the front and middle legs dilated and pilose beneath.

*Description*.—*General habitus*. Body small (9–10 mm); head and pronotum metallic crimson, laterally shiny blue and green; elytra shiny, dorsally dark black or copper-black, lateral margins with a wide area of violet, blue, green and red iridescence; two white lateral spots on apical half; body metallic violet and blue-green ventrally. *Head*. Mandibles asymmetrical distad basal molar on each sex, three teeth on right mandible and four teeth on left one (tooth nearest molar smallest); anterior surface mostly ivory on male, except for darkened teeth; only basal half ivory on female, remainder darkened; labrum long with an abrupt medial carina; labral surface smooth, uniformly pale with the anterior margin darkened at the middle; six to ten submarginal setae originating from large metallic setigerous punctures; female labrum medially with one small tooth; male labrum lacking teeth, anterior margin truncated at middle; penultimate segment of labial palpi dilated, nonmetallic, terminal segment small and black; frons finely rugose, rugae laterally vertical, medially forming a transverse wedge; vertex with coarse rugae forming large, nearly parallel ridges adjacent to eyes, pattern wavy and irregular medially; surface glabrous. *Prothorax*. Pronotal surface coarsely scabrous from irregular, wavy ridges on disc and moderately deep, transverse parallel grooves at lateral margin; proepisterna smooth and polished, on male dorsal two-thirds covered with sparse, appressed setae originating from large, setigerous punctures, on female sparser setae only on ventral third; prosternum transversely wrinkled, glabrous. *Pterothorax*. Mesepisterna glabrous except for a few setae at extreme posteroventral margin, surface slightly wrinkled on male, smooth and polished on female; female mesepisternal coupling sulcus a large, elongate pit near posterior margin. *Elytra*. Elytral disc shiny black or copper-black, lateral margins with a wide area of violet, blue, green and red iridescence uniformly tapering anteriorly to humeral angle and posteriorly to outer apical angle; two circular white spots at lateral margin, basal

one smallest; apex with microserulate margins gradually rounded on male, slightly truncated on female; sutural spine small. *Abdomen*. Anterior five sterna on each sex with sparse appressed setae near lateral margin, sixth sternum fringed with setae at extreme edge on male; remainder of surface glabrous, except for scant short hairs and several long primary setae. *Legs*. Trochanters pale testaceous, one subapical seta on each front and middle segment; femora dark, metallic except for testaceous distal end; tibiae and tarsomeres dark; male with proximal second and third tarsomeres of front and middle legs dilated and pilose beneath. *Male genitalia*. Aedeagus bulky, middle third uniformly wide, apical third narrowed abruptly and broadly tapering to apex; apex wide, displaced to the right; apical hook broad, gradually rounded and long.

*Distribution*.—(Fig. 49). Northern India (West Bengal, Bihar, Orissa, Madhya Pradesh, Andhra Pradesh). Fowler (1912) listed this species from Karnataka, but this and specimens! at MNHB from Mysore, India and Laos are probably mislabelled.

*Localities*.—INDIA: Madhya Pradesh: Kanha National Park, 15, 16, 17.VI.1982, forest path (DLPC); Andhra Pradesh: 57 km N Hyderabad, 4.VII.1986, scrub forest (CMNH); 15 km N Salur, 30.VI.1986, scrub forest (DLPC); 20 km N Narsipatnam, 28.VI.1986, scrub forest (CMNH); 57 km W Narsipatnam, 1.VII.1986, scrub forest (DLPC); 20 km N Waltair, 27.VI.1986, 550 m, scrub forest (DLPC); Bihar: Ranchi, 20.VI.1986, old field (DLPC); 85 km W Ranchi, 23.VI.1983, scrub forest (DLPC); 20 km S Palamau, 22.VI.1986, scrub forest (DLPC); Orissa: Simlipal National Park, 25.VI.1986, forest path (DLPC).

*Ecology*.—The adults occur within secondary growth forests and occasionally in open grassy fields during June and July.

### *Cicindela (Jansenia) chlorida* Chaudoir

*Cicindela chlorida* Chaudoir, 1865:56.

*Type status*. Syntype(s)? [unexamined; concept based on specimens! agreeing with original description from Coimbatore, Tamil Nadu, India, at CMNH]. *Type depository*. ?MNHN. *Type locality*. "Malabar Coast" (Kerala, India).

*Cicindela chlorida* Chaudoir: Fowler, 1912:334, fig. 150.

*Jansonia chlorida* (Chaudoir): Rivalier, 1961:134.

*Diagnosis*.—Distinguished by the brilliant green dorsal body color; elytra evenly contoured, uniformly dull green (a few specimens copper) on disc with broad shiny bronze metallic lateral margins; elytra lacking subsutural metallic foveae.

*Description*.—*General habitus*. Body medium (10–10.5 mm); head and pronotum green, a few specimens copper dorsally, bronze laterally; elytra evenly contoured on disc, uniformly dull green (a few specimens copper), lacking a subsutural row of metallic foveae, laterally with a broad, metallic copper margin and marked with two large spots on apical half; body ventrally with thorax metallic copper to copper-green, abdomen shiny blue-green to purple. *Head*. Mandibles symmetrical distad basal molar, tridentate; male apical tooth long, other two teeth short; female apical tooth not greatly longer than other teeth; labrum long; medial carina broad; female labrum entirely testaceous with one small medial tooth; male labrum darkened along anterior margin, lacking teeth and truncated; labrum with 10 to 14 submarginal setae except for one or two at anterior portion of medial carina; frons and vertex with rugae finely impressed and wavy, except for coarser parallel rugae adjacent to eyes. *Prothorax*. Pronotum with wavy rugae dorsally, setose at lateral margin; setae abundant on male, sparser on female except anteriorly; proepisterna roughened and wrinkled, covered by semierect and appressed setae; setae dorsally directed, originating from small setigerous punctures; prosternum with sparse erect setae. *Pterothorax*. Mesepisterna glabrous and finely wrinkled; female mesepisternal coupling sulcus a broad groove ventrally, narrowed dorsally. *Elytra*. Surface evenly contoured; dorsally uniformly dull, most specimens green (a few others copper); laterally margins broad, shiny metallic bronze; surface basally densely, deeply punctured, apically impunctate; two pale, yellow lateral spots (some specimens with small, irregular, intervening maculation) nearly touching margin; anterior spot smaller and rounded to slightly transverse; apical one larger, broadly elongate with the apical extension ending elytral apex some distance before suture; apex finely microserulate without a sutural spine; apical margins separately rounded. *Abdomen*. Anterior four sterna laterally with sparse appressed

setae, a few setae on fifth sternum, sixth sternum entirely glabrous, remaining sterna medially glabrous. *Legs.* Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora metallic along anterior surface except for testaceous distal end, remaining surfaces testaceous; tibiae and tarsomeres testaceous, darkened distal ends on each segment. *Male genitalia.* Aedeagus large and bulky, widest on middle half, tapering abruptly on distal quarter to a short acute apex displaced to the right and lacking a hook.

*Distribution.*—(Fig. 50). Southern India (Kerala and Tamil Nadu).

*Localities.*—INDIA: Tamil Nadu: Coimbatore, 430 m, X.1971 (CMNH, DLPC); Coimbatore, 430 m, X.1972, IX, X.1973, X, XI.1974, X.1976, X.1977 (CMNH); Coimbatore District, Marudamalai Hills, 550 m, X.1972 (CMNH).

*Ecology.*—The habitat of this localized species is unrecorded but presumably adults frequent scrub forests like related species. Adults emerge during September through November after the autumnal monsoon. Specimens are common in student collections at Tamil Nadu Agricultural University, so it is likely an abundant species in its preferred habitat near Coimbatore.

*Cicindela (Jansenia) psarodea*, new species

*Diagnosis.*—Distinguished by the medium body size; dark black, bronze or copper-green elytral disc with metallic foveae in a subsutural row; metallic copper-green femora.

*Description.*—*General habitus.* (Fig. 21). Body medium (10–11.5 mm); moderately robust; head and pronotum slightly shiny copper dorsally except for two small blue-green areas between eyes, laterally blue-green; elytra with two lateral spots on apical half; disc dull black, some specimens bronze, or copper-green with subsutural foveae; lateral margin broad, shiny green to bronze-green and purple band; body blue-green ventrally. *Head.* Glabrous except for supraorbital setae; vertex and frons covered by dense, deep wavy rugae whose pattern varies, arcuate on frons and behind eyes to parallel adjacent to eyes, irregular medially; eyes moderately bulging; genae glabrous, copper, straight rugae converging anteriorly; clypeus glabrous, copper, slightly wrinkled; male and female mandibles symmetrical, tridentate distad basal molar; apical tooth of male long, other two much shorter; all teeth of female coequal in size; labrum large, rounded in outline, surface smooth and unpigmented except black to dark brown along anterior margin and short anterior length of medial carina; 7 to 14 submarginal setae, a few posteriorly along carina; three acute teeth at anterior edge of labrum, teeth of male small and coequal in length; middle tooth of female largest; penultimate segment of labial palpi dilated and unpigmented; last segment of maxillary and labial palpi pigmented only on distal half; one erect seta on antennal scape. *Prothorax.* Dorsal outline subquadrate; anterior and posterior transverse sulci moderately impressed; pronotum copper on disc, small blue-green areas along medial line and in transverse sulci; pronotal surface glabrous except for sparse, appressed setae at anterolateral margins; surface densely and deeply rugose, rugae forming complex wavy patterns on disc, nearly parallel laterally; prosternum sparsely setose anterior of front coxae. *Pterothorax.* Female mesepisternal coupling sulcus a narrow, medial groove; female mesepisterna glabrous, polished and smooth; male mesepisterna glabrous with broad shallow wrinkles. *Elytra.* Elytral disc of most specimens copper-black, some specimens bronze, others copper-green; green foveae in a subsutural row and irregularly on apical half; shiny black-bronze and purple band laterally; large, dense punctures from humeral angle to first spot; shiny green to bronze-green and mostly impunctate with only sparse, small punctures between spots; two yellow spots at lateral margin, anterior spot wide and slightly transverse halfway toward suture, posterior spot elongate, occupying the outer apical quarter laterally; on some specimens spots separated, on other specimens a thin continuous lateral macula extends between the spots; apices microsculptured; apical margins separately rounded; small sutural spine. *Abdomen.* Anterior five sterna on female and all six on male covered by abundant, appressed setae. *Legs.* Trochanters pale testaceous, one subapical seta on each front and middle segment; femora metallic except for testaceous distal end; tibiae and tarsomeres pale, testaceous except for black distal end of each segment. *Male genitalia.* Aedeagus large, bulky, widest at middle third, tapering gradually on apical third to a short, acute apex, slightly bent to the right side, and lacking a hook.

*Body size.*—*Holotype.* Body length 11.2 mm, elytral width 4.1 mm. *Allotype.* Body length 10.7 mm, elytral width 3.8 mm.

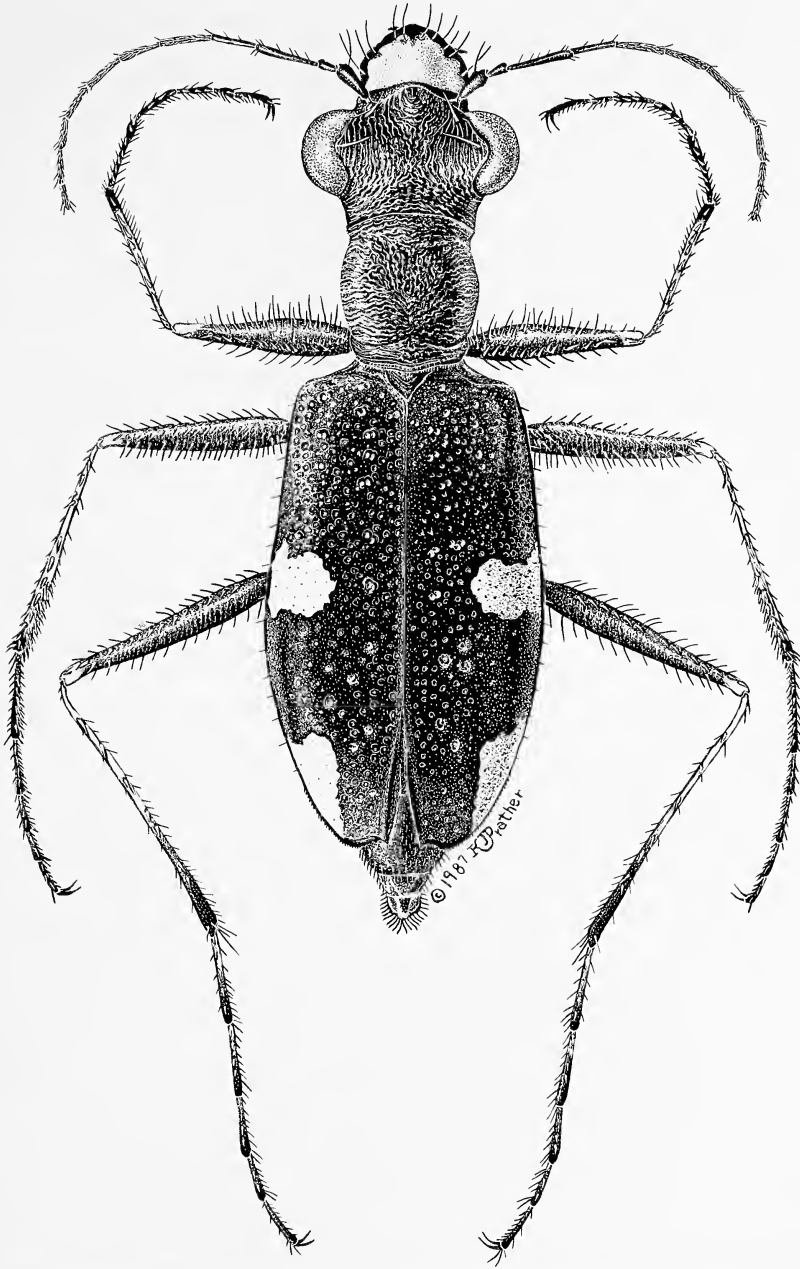


Fig. 21.—*Cicindela (Jansenia) psarodea*, new species, female holotype from Tumkur, Tumkur District, Karnataka, India. (Body size, 11.2 mm.)

*Type locality*.—Tumkur, Tumkur District, Karnataka, India.

*Type specimens*.—Holotype, female, labelled “INDIA: Karnataka, 15 km E Tumkur, 29.VI.1984, D.L. Pearson; scrub forest floor”; “HOLOTYPE, *Cicindela*, *psarodea*, Acciavatti &, Pearson” [typed and handprinted red label]. Allotype,



male and 12 paratypes with the same label data as holotype; 1 paratype from the type locality but collected "25.VI.1986." An additional 12 paratypes with the following collection data: "India, Mysore State, Bangalore 916 m, 3.VI.1973; on sandy path"; "India, Karnataka, Bangalore, 916 m, 11 and 28.VIII.1980"; "India, Karnataka, Bangalore, 915 m, 8.VI.1984 and 19.V.1985; scrub forest floor"; "India, Karnataka, Nalknadu, Coorg, 15.X.1983"; "India, Karnataka, 30 km S Bangalore, 12.VI.1983; old field"; "India, Karnataka, Hosakote, 19.VI.1986; scrub forest floor"; "India, Karnataka, 10 km E Hosakote, 22.VIII.1986; scrub forest"; "India, Karnataka, 5 km E Chintamani, 22.VII.1986; scrub forest."

*Type depository.*—Holotype, allotype and 5 paratypes to NMNH; remaining 20 paratypes distributed as follows: 1 each to BMNH and IARI; 2 each to CMNH and DEI; 14 to DLPC.

*Distribution.*—(Fig. 49). Southern India (southeastern Karnataka, northwestern Tamil Nadu). In addition to the type series, specimens! exist from India, Tamil Nadu, Coimbatore, A. K. Weld-Downing (BMNH).

*Ecology.*—Adults frequent openings in scrub forest and have been collected along sandy roads through open forest between 900 and 1200 m elevations during May and September.

*Etymology.*—The species name is feminine singular and derived from the Greek *psaro* (speckled) and *-odea* (resemblance) with reference to the pattern of shiny punctures and foveae on the dark elytra.

### *Cicindela (Jansenia) rostrulla*, new species

*Diagnosis.*—Distinguished by the medium body size; elytra smooth copper-brown with a subsutural row of contrasting green foveae; testaceous femora.

*Description.*—*General habitus.* (Fig. 22). Body medium (10–10.5 mm); head and pronotum of many specimens green, others copper to bronze; elytra copper-brown with a subsutural row of contrasting green foveae; metallic copper lateral band; two yellow spots along lateral margin on apical half; thorax ventrally copper, abdomen blue-green. *Head.* Female mandibles symmetrical, tridentate on each distad basal molar; all teeth on female mandible coequal in size; male mandibles asymmetrical, three teeth on right mandible, four on left; apical tooth on male mandible long, other teeth much shorter; labrum long, on males its length-to-width ratio equals or exceeds 0.7; labrum testaceous, anterior margin narrowly darkened, slightly darkened area at middle (most apparent on females) not extending onto the medial carina; 10 to 12 submarginal setae. *Prothorax.* Pronotum scabrous; disc glabrous, lateral margin with setae most numerous near anterior corners; proepisterna coarsely wrinkled, covered by dense appressed setae originating from small setigerous punctures; prosternum sparsely setose only anterior to front coxae. *Pterothorax.* Female mesepisternal coupling sulcus a narrow medial groove; mesepisterna glabrous except for appressed setae at posteroventral margin, surface shallowly wrinkled on female, coarsely wrinkled on male. *Elytra.* Lateral band uniformly metallic copper at edge grading to shiny green medially; punctures along entire lateral band densest and deepest basally; subsutural row of contrasting green foveae; two yellow spots along lateral margin on apical half. *Abdomen.* Sparse appressed white setae laterally only on first five sterna on each sex; all sterna medially and sixth sternum on male totally devoid of all but a fringe of setae at posterior margin. *Legs.* Trochanters pale testaceous, one subapical seta on each front and middle segment; femora pale testaceous, only anterior femora slightly metallic copper tinged; tibiae and tarsomeres testaceous, dark pitchy distal end. *Male genitalia.* Aedeagus large and bulky, middle half widest then tapering abruptly on apical quarter to a short, acute apex distinctly bent to the right and lacking a hook.

*Body size.*—*Holotype.* Body length 10.1 mm, elytral width 3.4 mm. *Allotype.* Body length 10.5 mm, elytral width 3.7 mm.

*Type locality.*—Pudukkottai, Pudukkottai District, Tamil Nadu, India.

*Type specimens.*—Holotype, male, labelled "INDIA: Tamil Nadu, Pudukkottai District, Pudukkottai, X.1984, T.R.S. Nathan, leg."; "HOLOTYPE, *Cicindela*, *rostrulla*, Acciavatti & Pearson" [typed and handprinted red label]. Female al-

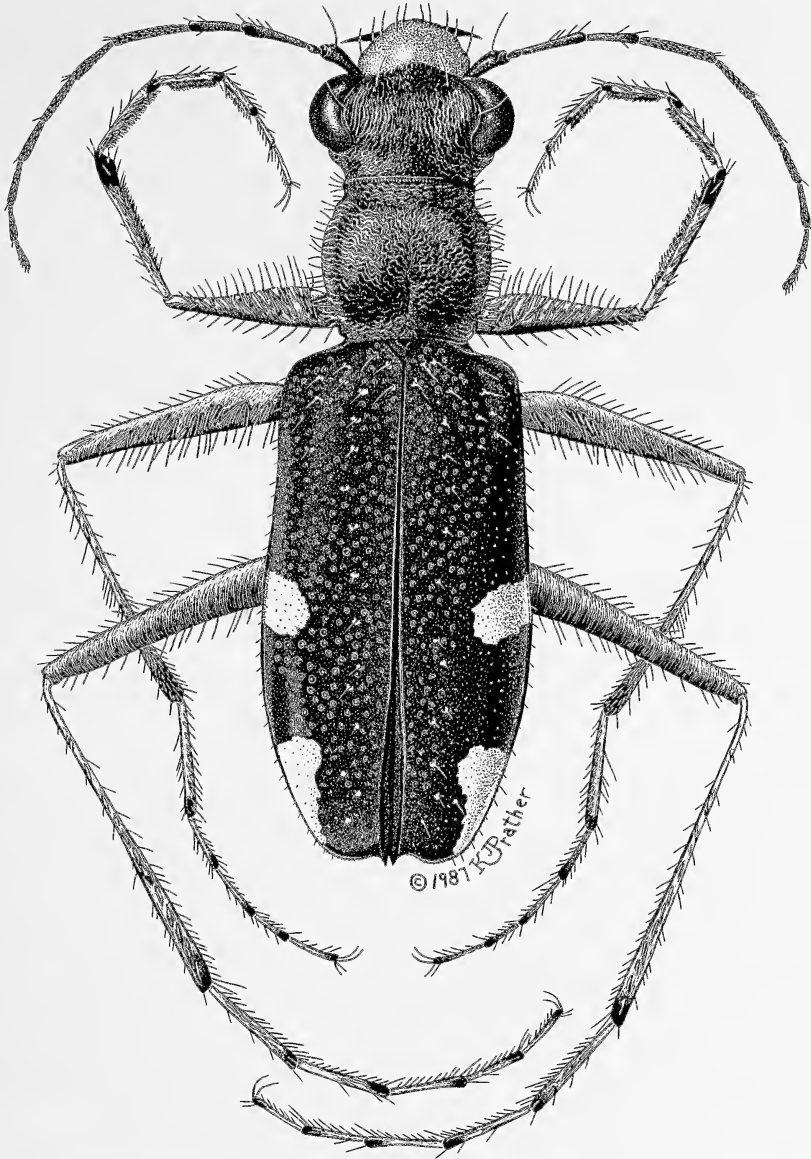


Fig. 22.—*Cicindela (Jansenia) rostulla*, new species, male holotype from Pudukkottai, Pudukkottai District, Karnataka, India. (Body size, 10.1 mm.)

lotype with same label data as holotype. An additional 23 paratypes labelled as follows: "India: Tamil Nadu, Pudukkottai (300 m), 21.X.1987, T. Shivashankar; scrub forest"; "India: Tamil Nadu, 25 km N Pudukkottai, 25.IX.1987, A.R.V. Kumar; scrub forest"; "South India, Madras State, Tiruchchirappalli District, Pudukkottai, X.1973 and X.1984"; "INDIA: Tamil Nadu, 20 km S Pudukkottai, 24.IX.1986, 250 m"; "South India, Salem District, 4.IX.1934"; "South India, Tope, foot of Palni Hills, 20–23.X.1922"; "Shembaganur, Madura, India (no date)."

*Type depository.*—Holotype, allotype and 2 paratypes at CMNH; 21 remaining paratypes distributed as follows: 7 to DLPC; 4 to UASB; 2 each to DEI, ZSI and NMNH; 1 each to IARI, HBC, HSC and AMNH.

*Distribution.*—(Fig. 49). Southern India (central Tamil Nadu).

*Ecology.*—Adults inhabit scrub forests where they emerge during the late summer and autumn monsoon from late September through late October.

*Etymology.*—Name is feminine singular and derived from the Latin *rostr-* (beak) and *-ulla* (a diminutive suffix) with respect to the large, prominent labrum.

*Remarks.*—Adults of this species superficially resemble those of *Cicindela chlorida* for body size and shape, but their elytra are copper-brown dorsally rather than green and have a subsutural row of contrasting green foveae which *C. chlorida* adults lack. *Cicindela rostrulla* adults are also similar to *C. psarodea* for elytral color and arrangement of foveae as well as body size but possess entirely testaceous femora rather than the metallic copper-green femora of *C. psarodea*. *Cicindela psarodea* adults appear during the summer and disappear by the time *C. rostrulla* adults are active during the autumn.

### *Cicindela (Jansenia) grossula* Horn

*Cicindela grossula* Horn, 1925a:137.

*Type status.* Holotype, female! [by monotypy]. *Type depository.* Holotype at DEI. *Type locality.* "Maniyachi, Southern Madras" (Tirunelveli District, Tamil Nadu, India).

*Diagnosis.*—Distinguished by the ovate elytral shape; dull, dark bronze elytral disc; slightly metallic lateral elytral margin; wide transverse band at middle on elytra.

*Description.*—*General habitus.* Body small (8 mm); head and pronotum dark bronze with violet reflections dorsally, contrasting sharply with dark blue-black lateral band; elytral shape ovate, surface dull, dark bronze dorsally, slightly metallic laterally with a wide transverse band at middle. *Head.* Labrum long, unidentate with six submarginal setae and anterior half darkened; penultimate segment of labial palpi slightly swollen; terminal segment of maxillary and labial palpi dark, but not metallic; vertex of head coarsely, wavy rugose. *Prothorax.* Pronotum rounded at lateral margin, surface with coarse, wavy ridges; proepisterna violet with large, wavy ridges and setae only on ventral half; prosternum setose at posterior margin. *Pterothorax.* Female mesepisternal coupling sulcus a deep pit medially at posterior margin. *Elytra.* Shape ovate, narrowest at humeral angle, widest at middle; maculae as a transverse middle band extending from lateral margin nearly to suture and a large subapical spot touching lateral margin but not reaching suture; elytral surface densely and deeply punctured anterior to middle band and impunctate posterior to it; sutural spine small, retracted; elytral apices separately rounded and microserrulate. *Abdomen.* Sterna metallic blue-green with sparse lateral setae. *Legs.* Trochanters testaceous, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic blue-green and copper. *Male genitalia.* Not examined.

*Distribution.*—(Fig. 50). Known only from the type specimen collected in southern Tamil Nadu, India.

*Localities.*—INDIA: Tamil Nadu: Tirunelveli District, Maniyachi (DEI).

*Ecology.*—No details are known about the habitat preference of this species which probably has a restricted period of adult activity.

### *Cicindela (Jansenia) venus* Horn

*Cicindela venus* Horn, 1907a:22.

*Type status.* Lectotype, female [here designated]. *Type labels.* "Nilgiri Hills" [typeset]; "Type!, Dr. W. Horn" [typeset within a thin black border]; "Andrewes" [handscript]; "Syntypus" [typeset red label]; "EBERSWALDE, DEI" [typeset]; "LECTOTYPE, Cicindela, venus W. Horn, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 11 mm.] Paralectotype, male at BMNH

[here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. [A syntype at BMNH, London (G. G. Kibby, personal communication, 1983); unexamined.] *Type depository*. Lectotype at DEI; paralectotype at BMNH. *Type locality*. "Nilgiri Hills" (Tamil Nadu, India).

*Cicindela venus* Horn: Fowler, 1912:328, fig. 146.

*Jansonia venus* (Horn): Rivalier, 1961:135.

**Diagnosis.**—Distinguished by the nonmetallic, pale testaceous labial palpi; blue iridescent humeral elytral angle, lateral and sutural elytral margins.

**Description.**—*General habitus*. Body medium (11–12 mm); head and pronotum copper, brilliant metallic blue-green to purple margins and depressions; elytra dull copper, marginal blue-violet iridescence widened at humeral angle, along entire lateral margin and suture, iridescence broadly joining at apex, maculae consisting of a transverse middle band and round subapical spot; body purple and green ventrally. *Head*. Mandibles distad basal molar symmetrical, each sex tridentate; penultimate segment of labial palpi slightly dilated, terminal segment entirely testaceous and nonmetallic; labrum long with a broad medial carina, smooth and shiny brown, heavily tinged with metallic purple; eight submarginal setae; female labrum with one small medial tooth; male labrum with anterior margin evenly rounded and lacking teeth; frons with numerous, shallow, rugae forming numerous narrow, regular and parallel ridges extending uniformly onto vertex except medially; deeply and broadly concave vertex; large bulging eyes; head glabrous except for a pair of supraorbital setae. *Prothorax*. Pronotum longer than wide, narrower than head and elytra; shape cylindrical, anterior collar formed by deeply and evenly impressed anterior transverse sulcus; pronotal surface with numerous moderately impressed rugae forming transversely parallel ridges from lateral margin to medial line; pronotum glabrous; proepisterna smooth and polished with shallow wrinkles, glabrous; prosternum glabrous. *Pterothorax*. Mesepisterna glabrous on each sex; female mesepisternal coupling sulcus a narrow, medial groove. *Elytra*. Elytral disc dull copper with iridescent blue lateral margin, widened at humeral angle, extending all along margin and broadly joining the iridescent blue suture at apex; elytral surface granulate-punctate with small punctures basally becoming only slightly shallower and less dense apically; maculae yellow; transverse to slightly arcuate middle band and round spot on apical third; apical margin with small microserrulations; small broadly acute sutural spine; apical edge separately rounded on each sex, more so on female than male. *Abdomen*. Sterna shiny purple and green, glabrous. *Legs*. Trochanters translucent testaceous, one subapical seta on each front and middle segment; femora testaceous, slight metallic sheen especially along anterior surface; tibiae and tarsomeres testaceous to dark brown, tinged with purple. *Male genitalia*. Aedeagus moderately long, bulky, widest at middle third, tapering gradually on apical third to a short, rounded apex slightly displaced to right side and lacking a hook.

**Distribution.**—(Fig. 50). Southern India (northwest Tamil Nadu, southwestern Karnataka).

**Localities.**—INDIA: Karnataka: Shimoga District, Agumbe Ghat, 615 m, V.1973, V.1974, V.1981, V.1987 (CMNH); Agumbe Ghat, 12.V.1985, moist creek bed (DLPC); 5 km N Mudigere, 5.VI.1984, forest path (DLPC).

**Ecology.**—Adults frequent the shaded floor of coffee plantations and mature forest above 700 m elevations during May. Moist habitats on mossy rocks by a small river and in shaded areas along roads were reported by Fowler (1912), who considered this species to be semiarboreal.

### *Cicindela (Jansenia) stuprata* Horn, new rank

*Cicindela venus stuprata* Horn, 1909:446.

*Type status*. Holotype, female! [by monotypy]. *Type depository*. Holotype at DEI. *Type locality*. "Wallardi, Travancore" (Kerala, India).

*Jansonia venus stuprata* (Horn): Rivalier, 1961:135.

**Diagnosis.**—Distinguished by the nonmetallic, pale testaceous labial palpi; shiny copper iridescent humeral elytral crescent; blue lateral elytral margin.

**Description.**—*General habitus*. Body small (9–10 mm); head and pronotum shiny crimson, brilliant green laterally and in depressions; elytra dull bronze, nearly black; shiny copper iridescent humeral

crescent; blue iridescence laterally on elytra; suture violet-black; middle band pale yellow and transverse, a round spot on apical third; body purple and green ventrally. *Head.* Mandibles distad basal molar, symmetrical on male with four teeth (tooth between first and third minute), asymmetrical on female with three teeth on left mandible and four on right one (tooth between first and third minute); penultimate segment of labial palpi slightly dilated, terminal segment entirely testaceous and non-metallic; labrum long with a broad medial carina, smooth and shiny black, metallic purple and green, four to six submarginal setae, female with one small medial tooth, male with anterior margin nearly straight across and lacking teeth; frons with numerous shallow rugae forming narrow, regular and parallel ridges extending uniformly onto vertex; vertex deeply and broadly concave with large, bulging eyes; frons, vertex and genae glabrous except for two pairs of supraorbital setae. *Prothorax.* Pronotum longer than wide, distinctly narrower than head and elytra, cylindrical; distinctive anterior pronotal collar formed by deeply and evenly impressed anterior transverse sulcus; pronotal surface with numerous moderately impressed rugae forming transversely parallel ridges from lateral margin to medial line; pronotum entirely glabrous; proepisterna smooth and shiny, entirely glabrous with numerous shallow fine parallel wrinkles over most of dorsal two-thirds, posterior margin polished; prosternum glabrous with moderately impressed, parallel rugae. *Pterothorax.* Mesepisterna glabrous on each sex; female mesepisterna smooth and polished; coupling sulcus a shallow, circular pit medially. *Elytra.* Dull bronze nearly black on disc and along suture with an iridescent copper humeral crescent, laterally violet-black iridescence extends almost to apex; elytral surface granulate-punctate with small punctures basally becoming only slightly shallower and less dense apically; yellowish white maculae comprising a transverse band at middle and a round spot on apical third slightly anterior to outer apical angle; apex with fine microserrulations, sutural spine indistinct, margin gradually and uniformly rounded. *Abdomen.* Sterna completely glabrous. *Legs.* Trochanters testaceous translucent, one subapical seta on each front and middle segment; femora nonmetallic testaceous translucent, dark brown-black distal end; tibiae and tarsomeres dark brown-black, tinged with purple. *Male genitalia.* Aedeagus short, bulky, slightly bulbous, tapering abruptly distad to a short, broadly rounded apex not displaced to right side and lacking a hook.

*Distribution.*—(Fig. 50). Southern India (western Tamil Nadu).

*Localities.*—INDIA: Tamil Nadu: Anaimalai Hills, Cinchona, 1075 m, V.1976 (CMNH, DLPC).

*Ecology.*—The habitat of this species is unrecorded but adults are probably similar to *Cicindela venus* which frequents forests, except adults are found above 1000 m elevations during May.

*Remarks.*—*Cicindela stuprata* should be separated from *C. venus* because its females possess a pit for a mesepisternal coupling sulcus whereas *C. venus* females have broadly grooved mesepisterna.

### *Cicindela (Jansenia) fusissima*, new species

*Diagnosis.*—Distinguished by the nonmetallic, pale testaceous labial palpi; non-metallic humeral elytral angle with pale testaceous markings; coxae pale and testaceous.

*Description.*—*General habitus.* (Fig. 23). Body small (8.5–9.5 mm); head and pronotum shiny crimson with brilliant green and purple laterally and in medial depressions; elytra parallel sided, surface slightly shiny copper, contrasting blue-green punctures and a black and purple lateral edge; suture copper to black; humeral angle nonmetallic and marked with a yellow-orange spot (widened on some specimens) extending posteriorly to a narrow pale yellow middle band; separate rounded spot near margin at outer apical angle; body ventrally purple, black and green almost totally glabrous except for small setal patches on pro-, meso- and metasterna and their respective coxae. *Head.* Mandibles symmetrical distad basal molar on each sex with four teeth (minute teeth between first and third); penultimate segment of labial palpi slightly dilated, terminal segment testaceous and nonmetallic; labrum long with a broad medial carina, smooth and shiny black, metallic purple and green, six to eight submarginal setae, female with one small medial tooth, male with anterior margin broadly rounded and lacking teeth; frons with numerous rugae forming narrow parallel ridges extending onto vertex laterally, irregular and arcuate at junction with vertex medially; vertex deeply and broadly concave with numerous moderately incised nearly parallel rugae between eyes which merge with wavy and somewhat transverse rugae posteriorly; eyes large and bulging; head entirely glabrous except for a pair of supraorbital setae. *Prothorax.* Pronotum longer than wide, narrower than head and elytra,

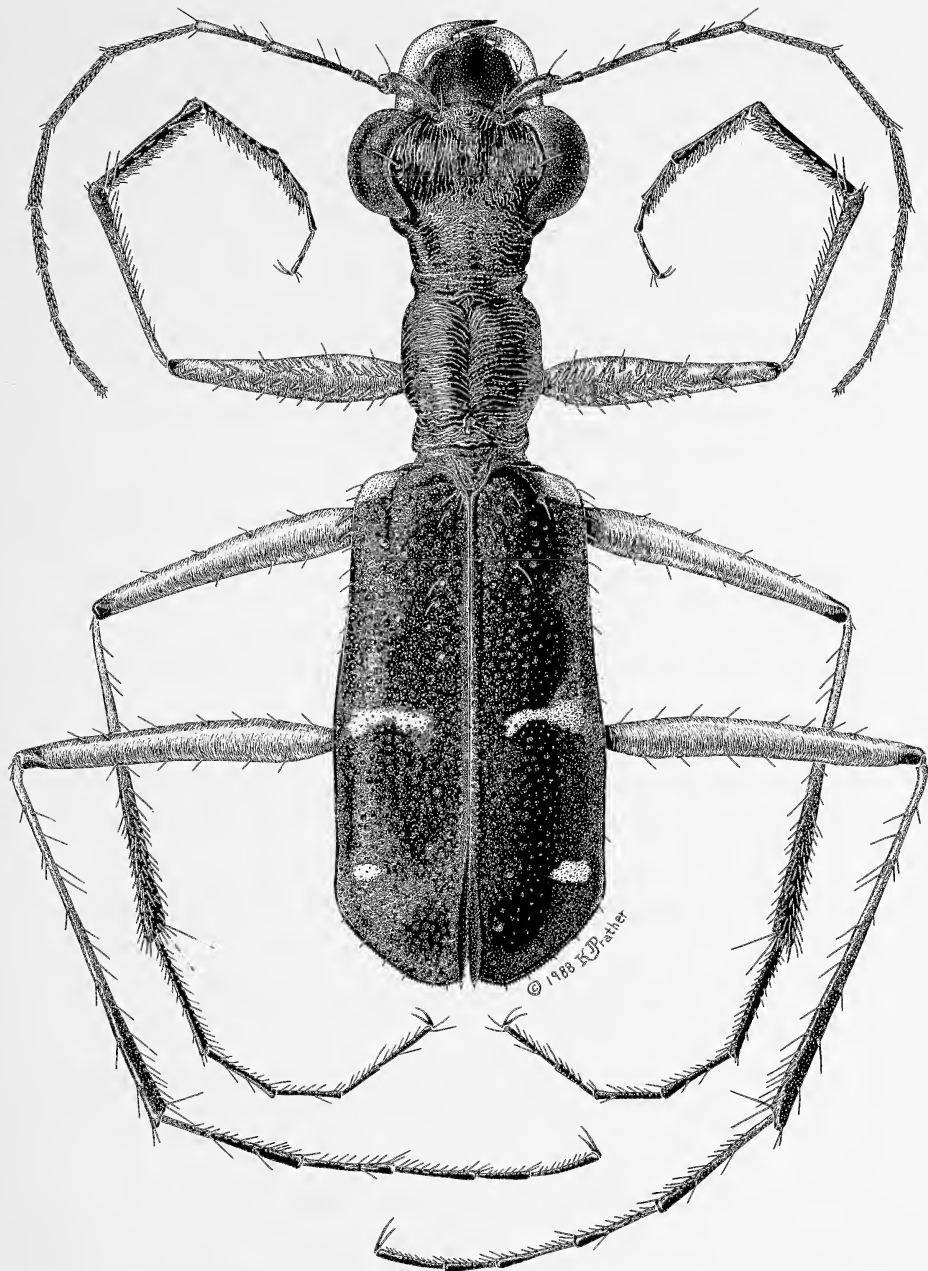


Fig. 23.—*Cicindela (Jansenia) fusissima*, new species, male holotype from Poonmudi Range, 3000 feet (925 m), Trivandrum District, Kerala, India. (Body size, 8.9 mm.)

distinctly cylindrical in shape and bulging at anterior and posterior margins because of constrictions from transverse sulci, anterior sulcus more deeply and evenly impressed than posterior sulcus; pronotal surface with numerous moderately impressed rugae forming transversely parallel ridges from lateral margin to medial line; pronotum entirely glabrous; proepisterna smooth and shiny, entirely glabrous with numerous shallow parallel wrinkles over most of dorsal two-thirds, posteriorly polished with a

broadly and deeply incised groove; proepimera with a few setae near procoxae; prosternum glabrous with moderately impressed, parallel rugae. *Pterothorax*. Mesepisterna glabrous on each sex; female mesepisterna smooth and polished; coupling sulcus a moderately deep, circular pit medially; male mesepisterna finely wrinkled. *Elytra*. Surface slightly shiny copper, granulate-punctate; small contrasting blue-green punctures basally only slightly shallower and less dense apically; black and purple lateral edge extending almost to apex; suture copper to black; humeral angle nonmetallic, pale yellow-orange spot extending posteriorly and slightly mesad lateral edge as a diffuse wavy orange band (on some specimens spot wide and distinct) broadly meeting pale yellow middle band, the latter transversely arcuate; pale yellow rounded spot at the outer apical angle; apical margin with fine microserrulations; sutural spine small to minute; gradually rounded apical margins slightly truncated at apex. *Abdomen*. Sterna glabrous except for two long primary setae on the fourth and fifth sterna. *Legs*. Coxae testaceous, pro- and mesocoxae with slight metallic sheen, metacoxae translucent; trochanters pale testaceous, one subapical seta on each front and middle segment; femora nonmetallic testaceous and translucent, except for a slightly darker distal end; tibiae and tarsomeres dark brown-black, purple tinged. *Male genitalia*. Aedeagus short, bulky, slightly bulbous, widest at basal half and tapering abruptly to a rounded hookless apex with a small projecting beak on the right side.

*Body size*.—*Holotype*. Body length 8.9 mm, elytral width 2.4 mm. *Allotype*. Body length 9.2 mm, elytral width 2.6 mm.

*Type locality*.—India, Kerala, Trivandrum District, Poonmudi Range, 3000 ft.

*Type specimens*.—Holotype, male, labeled "Trivandrum Dt., Poonmudi Range, Kerala State, INDIA 3000 feet, May 1971, T.R.S. Nathan"; "HOLOTYPE, *Cicindela fusissima*, Acciavatti & Pearson" [typed and handprinted red label]. Female allotype similarly labelled.

*Type depository*.—Holotype at CMNH; allotype to RLHC.

*Distribution*.—(Fig. 50). South end of Western Ghats in southern India (southern Kerala).

*Ecology*.—The habitat is not known but likely similar to *Cicindela venus* and *C. stuprata* whose adults are found in moist forests.

*Etymology*.—This feminine singular name is derived from the Latin *fus* (spindle) and *-issima* (a superlative suffix) with reference to the narrow, spindle-shaped form of the pronotum.

*Remarks*.—*Cicindela fusissima* is closely related to *C. stuprata*. The male genital apex has a small, projecting beak for *C. fusissima* but is uniformly rounded for *C. stuprata*.

### *Cicindela (Jansenia) chloropleura* Chaudoir

*Cicindela chloropleura* Chaudoir, 1865:59.

*Type status*. Syntype(s)? [unexamined; concept based on its description relative to specimens! from 65 km N Kalka, Himachal Pradesh, India, at DLPC]. *Type depository*. ?MNHNP. *Type locality*. "North Hindostan" (India).

*Cicindela (Thoeputica) chloe* Dokhtoureff, 1887a:156.

*Type status*. Holotype, male! [by monotypy]. *Type depository*. Holotype at DEI. *Type locality*. "Indes Orientales."

*Jansonia chloropleura* (Chaudoir): Rivalier, 1961:135.

*Cicindela chloropleura coeruleolabris* Mandl, 1975:138.

*Type status*. Syntype(s)? [unexamined; concept based on its original description]. *Type depository*. ?ZSBS. *Type locality*. "Wangdi Phodrang, Bhutan."

*Jansonia chloropleura* (Chaudoir): Naviaux, 1985:67, fig. 17, 45, 83.

*Diagnosis*.—Distinguished by the globose pronotum; lateral elytral bands iridescent blue or green, straight edged, wide and continuous contrasting with copper



or olive green disc; lateral bands join a blue suture apically; two elytral spots laterally on apical half.

*Description.*—*General habitus.* Body medium (10–12 mm); head and pronotum dorsally brilliant copper, laterally metallic blue, violet or green margins; elytra disc dull, copper-brown or olive green with a straight-edged, iridescent blue or green lateral margin and a narrow suture, both meeting apically, two spots on apical half; body purple-black and metallic green ventrally. *Head.* Mandibles symmetrical with four large teeth distad basal molar on each sex; labrum shiny metallic, blackish red, blue to blue-green; medial carina abrupt; anterior margin convex and lacking teeth on male, one medial tooth on female; frons and vertex with coarse rugae forming irregular wavy patterns except for parallel ridges adjacent to eyes; surface glabrous. *Prothorax.* Pronotum globose, entirely glabrous with a deep anterior and posterior transverse sulcus, each blue-green and contrasting with copper disc; pronotal surface with coarse parallel rugae forming a transverse pattern; proepisterna smooth to shallowly wrinkled, sparse setae on ventral third; prosternum glabrous, surface wrinkled. *Pterothorax.* Female mesepisternal coupling sulcus a broad, medial groove. *Elytra.* Surface with large, dense punctures basally which become only slightly shallower and less dense apically such that apex is nearly impunctate; two white spots on apical elytral half touching lateral iridescence; apex finely microserulate; apical margins separately rounded, more so on female than male; sutural spine small. *Abdomen.* All sterna on each sex glabrous. *Legs.* Trochanters nonmetallic dark brownish black, one subapical seta on each front and middle segment; femora opaque, metallic purple to purple-green; tibiae and tarsomeres dark opaque purple. *Male genitalia.* Aedeagus large, bulky, widest at middle half, conical on apical three-quarters, tapering gradually to a short, acute apex slightly bent to the right side and lacking a hook.

*Geographic variation.*—We recognize two subspecies of *Cicindela chloropleura*: the nominal subspecies with a blackish red or green labrum and *Cicindela chloropleura coeruleolabris* with a blue to blue-green labrum. Specimens otherwise assignable to the nominal subspecies from central Nepal possess completely setose proepisterna rather than glabrous ones on the dorsal half as found in populations farther west.

*Distribution.*—(Fig. 50). The nominal *Cicindela chloropleura* is found across the north of the Indian subcontinent in India (Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim, West Bengal), Nepal and Bangladesh; *Cicindela chloropleura coeruleolabris* occurs in Bhutan.

*Localities.*—*Cicindela chloropleura chloropleura.* INDIA: Uttar Pradesh: Dehra Dun (DEI); Himachal Pradesh: 6.5 km N Kalka, 17.VII.1982, rocky river bed (CMNH, DLPC). NEPAL: Mandan Valley, 1100 m, 15.VI.1957 (MCZC); Amlekhganj, 520 m, 16.IV.1956 (MCZC); Bagamati, Bhotekoshi-Khola, Lamosangu, 700 m, 30.VI.1987 (CMNH, JPC); Janakpur, Kabre nach Tamba-Koshi-Khola (SE Charikot), 900 to 1900 m, 15.VI.1987 (CMNH, JPC). Naviaux (1985) listed nine localities from central and eastern Nepal. *Cicindela chloropleura coeruleolabris.* BHUTAN: Wangdi Phodrang (Mandl, 1975).

*Ecology.*—The adults are found on boulders and near vertical rockfaces along mountain sides and streams. Naviaux (1985) reported this species from forests along trails.

### *Cicindela (Jansenia) viridicincta* Horn

*Cicindela viridicincta* Horn, 1894a:173.

*Type status.* Lectotype, male [here designated]. *Type labels.* “Type” [typeset circular label with red border]; “Kanara, S. India” [typeset separated by a yellow line]; “Andrewes, Bequest., B.M. 1922-221” [typeset]; “Canara” [typeset]; “Cicindela, viridicincta, Type Horn” [handscript]; “LECTOTYPE, Cicindela, viridicincta W. Horn, by R.E. Acciavatti, '83” [typed and handprinted red label]. [Lectotype is 10 mm; right hind leg missing; broken left antenna.] Paralectotypes, male at MNHB, two males and one female at DEI, each [here designated] labelled “PARALECTOTYPE” [typed and handprinted red label]. [Three syntypes at BMNH (G. G. Kibby, personal communication, 1983); unexamined.] *Type depository.* Lectotype at BMNH; paralectotype at MNHB; three paralectotypes at DEI. *Type locality.* “Nord-Canara” (North Kanara, India).

*Cicindela viridicincta* Horn: Fowler, 1912:328, fig. 145.

*Jansonia viridicincta* (Horn): Rivalier, 1961:135.

**Diagnosis.**—Distinguished by the wide, straight-edged iridescent violet-black lateral elytral bands which contrast with copper disc; lateral bands not reaching apex and separated from green suture; elytral spots small and varied, specimens with one, two or none.

**Description.**—*General habitus.* Body small to medium (9–12 mm); head and pronotum brilliant copper dorsally, shiny violet-green laterally; elytra dorsally copper from base to apex, laterally green with a wide, straight-edged, iridescent violet-black band along margin from humeral angle to outer apical angle and a green suture both terminating before apex; maculae varied, entirely absent on some specimens, as one or two small inconspicuous dots on apical third on other specimens; body ventrally smooth, shiny black tinged with metallic green. *Head.* Mandibles symmetrical on each sex, four teeth distad basal molar on male, but three teeth on female; labrum dull metallic copper, surface smooth; medial carina abruptly and narrowly raised; six to eight submarginal setae (one or two more setae on a few specimens originating at anterior end of medial carina); labrum feebly tridentate and concave along anterior margin on male, one prominent medial tooth on female; coarse rugae as transverse and vertical patterns on frons; coarse rugae parallel from eyes to midline, rugae wavy on vertex; frons, vertex and genae glabrous. *Prothorax.* Pronotum entirely glabrous, parallel sided; shallow anterior and posterior transverse sulci same color as disc; coarse parallel rugae forming a transverse wavy pattern on pronotal disc, lateral margins smooth and polished; proepisterna shiny black, smooth and polished, sparse setae originating from small setigerous punctures on ventral third; prosternum glabrous, surface smooth. *Pterothorax.* Mesepisterna smooth and shiny black with sparse appressed setae at postero-ventral margin; female mesepisternal coupling sulcus a small pit medially at posterior margin. *Elytra.* Minute surface granules basally adjacent to small widely spaced punctures, granules abruptly smaller apically, impunctate on apical third; elytral maculae varied; none, one or two (three on a few specimens) small spots (minute dots on some specimens, inconspicuous dots on a few others) on apical third; microserrulations small; apical margin uniformly and separately rounded; sutural spine small. *Abdomen.* Sterna shiny black, metallic green tinged; only anterior five sparsely setose laterally, setae grouped along posterior margin, medially glabrous. *Legs.* Trochanters nonmetallic dark brownish black, one subapical seta on each front and middle segment; femora opaque, metallic purple to purple-green; tibiae and tarsomeres dark opaque purple. *Male genitalia.* Aedeagus small, bulky, globose, tapering abruptly to a small short rounded apex displaced to the right side, lacking a hook and supported by a long flange extending toward base for one-third the entire length lying off center in left and right lateral aspects.

**Distribution.**—(Fig. 50). India (Karnataka, Goa, Maharashtra, Tamil Nadu).

**Localities.**—INDIA: Karnataka: 14 km E Dandeli, 700 m, 12.VI.1984, road cut (DLPC, CMNH); 20 km W Shimoga, 11.VI.1985, scrub forest floor (DLPC); 60 km NE Mangalore, 3.V.1985 (DLPC); Mudigere, 17.V.1986, forest path (DLPC); Maharashtra: 10 km W Thane, 28.VI.1985, forest path (DLPC). A specimen! from Barway, Bihar, India, is likely mislabelled and records from Dehra Dun, Uttar Pradesh, India (Heynes-Wood and Dover, 1928), are erroneous.

**Ecology.**—Adults are found along road cuts and open parts of forest usually near steep slopes during May and June.

### *Cicindela (Jansenia) azureocincta* Bates

*Cicindela azureocincta* Bates, 1878b:333.

**Type status.** Syntype(s)? [unexamined; concept based on female! at DEI from the type locality]. **Type depository.** ?MNHN. **Type locality.** "Bombay" (Maharashtra, India).

*Euryoda azureocincta* (Bates): Horn, 1892c:537.

*Jansonia azureocincta* (Bates): Rivalier, 1961:135.

**Diagnosis.**—Distinguished by the wide wavy edge to the purple and blue iridescent lateral elytral bands, contrasting copper disc; lateral bands joining blue suture apically; two elytral spots laterally on apical half.

*Description.*—*General habitus.* Body small (8–9 mm); head bright copper, two large blue iridescent areas on vertex often broadly joining colored areas laterally; pronotum bright copper-red, broad purple band at margin and a blue-green at middle which broadly extends into deepened anterior and posterior transverse sulci; elytra copper on disc, the entire lateral margin with wavy purple and blue iridescence, suture blue, two spots laterally on apical half; body shiny black ventrally. *Head.* Mandibles symmetrical on each sex with four teeth distad basal molar; labrum metallic purple or green; broad medial carina; four to six submarginal setae; labrum tridentate on female, middle tooth longest and most acute; labrum on male lacking teeth, anterior margin concave or slightly wavy; frons with fine rugae forming a generally transverse pattern; vertex with fine wavy rugae medially but coarser rugae form parallel ridges adjacent to large bulging eyes; surface glabrous. *Prothorax.* Pronotum entirely glabrous, shape globose; deeply impressed anterior and posterior transverse sulci; pronotal surface finely rugose, rugae forming a slightly transverse wavy pattern on disc but lateral margins shallowly wrinkled; proepisterna shiny black, with shallow wrinkles and sparse setae originating from small setigerous punctures on ventral third on male; proepisterna entirely glabrous on female; prosternum glabrous with a smooth surface. *Pterothorax.* Mesepisterna shiny black; male mesepisterna shallowly wrinkled, sparse appressed setae at posteroventral margin; female mesepisterna smooth and nearly entirely glabrous; coupling sulcus a deep dorsal pit along posterior margin joining a shallow groove ventrally. *Elytra.* Surface slightly granulate-punctate, small punctures basally becoming shallower and less dense apically, apex nearly impunctate; two spots on apical half, each touching medial projections from the lateral iridescent band; microscerrulations small; sutural spine broad, indistinct; apical margins uniformly and separately rounded. *Abdomen.* Sterna shiny black, metallic green tinged; all six sterna on male sparsely setose laterally; only anterior five sterna on female sparsely setose laterally, tendency for setae to group along posterior margin; all sterna glabrous medially on each sex. *Legs.* Trochanters nonmetallic reddish testaceous, one subapical seta on each front and middle segment; femora metallic blue-green to purple-green or reddish testaceous (some specimens darkened along anterior edge), except for a blackened distal end; tibiae and tarsomeres dark sooty black. *Male genitalia.* Aedeagus small, bulky, widest on middle half with a short flange lying off center in left and right lateral aspects; tapering abruptly on apical quarter to short, broadly rounded hookless tip on the right side in left lateral aspect.

*Geographic variation.*—Femora are pale testaceous on specimens! from Karnataka, but metallic on the specimens! from northern Maharashtra at the type locality. Further study of more specimens may indicate that these populations are subspecifically distinct.

*Distribution.*—(Fig. 51). West coast of India and the interior southeastern part of the Deccan Plateau (Maharashtra, Goa, Karnataka).

*Localities.*—INDIA: Maharashtra: Bombay (DEI); 10 km W Thane, 28.VI.1985, forest path (DLPC); Goa (DEI); Karnataka: Kanara (DEI); Marmagao (DEI); 14 km E Dandeli, 700 m, 12.VI.1984, road cut (DLPC, CMNH); Jog Falls, 10.VI.1985, forested cliff top (DLPC).

*Ecology.*—Adults occur along road cuts and in open areas near steep banks above 700 m during June.

### *Cicindela (Jansenia) rugosiceps* Chaudoir

*Cicindela rugosiceps* Chaudoir, 1865:57.

*Type status.* Syntype(s)? [unexamined; concept based on its original description in comparison with specimens! from Tenmalai, Quilon District, Kerala, India, at CMNH]. *Type depository.* ?MNHN. *Type locality.* “Malabar coast” (Kerala, India).

*Cicindela rugosiceps* Chaudoir: Fowler, 1912:333, fig. 149.

*Jansonia rugosiceps* (Chaudoir): Rivalier, 1961:135.

*Diagnosis.*—Distinguished by the wide, iridescent blue lateral elytral bands which contrast with a copper or olive green disc; lateral bands interrupted at the middle by lateral extensions of crimson, greenish yellow or green medial stripe; two spots medially on disc.

*Description.*—*General habitus.* Body medium (11–12 mm); head copper with brilliant metallic blue or green lateral margins; pronotum with both sulci broadly purple and green in contrast to copper

disc; elytra dull crimson, greenish yellow or green (copper on a few specimens), medial stripe branching to the side margin on middle third and broadly interrupting iridescent blue lateral margin which narrowly joins blue suture at apex, two circular spots at middle of disc on apical half; body metallic purple, black and blue-green ventrally. *Head*. Mandibles symmetrical on each sex with four large teeth distad basal molar; labrum shiny metallic red, purple or green; labral surface rough and uneven; broad flattened medial carina; six to ten setae, most submarginal but one or two medially and close to clypeus on carina; labrum on female long and tridentate with small teeth coequal in size, widely spaced along anterior margin; labrum on male short and quadrate with only two lateral teeth, anterior margin concave or slightly wavy; frons and vertex with coarse rugae forming irregular pattern of wavy ridges medially but generally parallel ridges adjacent to large bulging eyes; surface glabrous. *Prothorax*. Pronotal disc glabrous, lateral margin glabrous (a few appressed setae on some specimens); shape globose; deeply impressed anterior and posterior transverse sulci, moderate bulge at posterior angle; pronotal surface coarsely scabrous on disc; lateral margins, anterior and posterior reflexed margins smooth on most specimens, shallow transverse wrinkles on a few specimens; proepisterna shiny black, smooth and polished on most specimens, shallow wrinkles dorsally on a few others; sparse setae originating from small setigerous punctures over most of the surface; prosternum shallow, transversely wrinkled, glabrous except for one or two setae at coxal margin. *Pterothorax*. Mesepisterna smooth and shiny with long, decumbent setae along posteroventral margin; female mesepisternal coupling sulcus a deep pit at posterior margin above middle. *Elytra*. Dull crimson, with a brilliant greenish yellow to green (some specimens copper) medial stripe along the entire length with an extension to the side margin on the middle third; lateral iridescent blue margin occupying most of humeral angle and interrupted broadly anterior to middle by color from disc but apically narrowly joined to iridescent blue suture; elytral disc surface slightly granulate-punctate, small punctures most numerous but a few larger punctures basally; punctures distinctly shallower and sparser apically, apex nearly impunctate, whereas surface of humeral area with large, dense punctures coalescing on some specimens; two circular spots one behind the other medially on apical half; apices finely microserulate; sutural spine acute, long on female, shorter on male; apical margins evenly and separately rounded, more abruptly on female. *Abdomen*. Moderate amounts of decumbent setae in patches near lateral margin on anterior five sterna on female and all six on male, glabrous medially on both sexes. *Legs*. Trochanters non-metallic pitchy black, one subapical seta on each front and middle segment; femora metallic crimson, blue, green and purple except for a black distal end; tibiae and tarsomeres purple black. *Male genitalia*. Aedeagus slender, slightly bulky, widest at middle and tapering gradually on apical third to a long rounded apex displaced to the right side and lacking a hook.

*Geographic variation*.—The elytra maculae are larger and more distinct, the pronotum has more lateral setae, and the brilliant humeral area is densely and deeply punctate on specimens from the northwestern portion of the range of this species.

*Distribution*.—(Fig. 51). Southern India (Tamil Nadu, Kerala, Karnataka).

*Localities*.—INDIA: Tamil Nadu: Coimbatore District, Nilgiri Hills, Singara, V.1948 (CMNH); 60 km E Coimbatore, 17.VI.1983, rocky riverside and large boulders (DLPC); 30 km N Salem, 26.VI.1984, rock face (DLPC); 25 km S Pollachi, V.1983 (CMNH); Anaimalai Hills, Topslip, 770 m, V.1977 (CMNH); Madurai District, Shembaganur, Palni Hills, 1000 m, VI.1978 (CMNH); 20 km N Kodai-kanal, 26.IX.1986, rock face (DLPC); Kumili, 770 m, V.1976 (CMNH); Ramanathapuram District, Ramnad (DEI); Kerala: Quilon District, Thenmalai, V, VI.1985, V.1988 (CMNH); Karnataka: Mysore, 13.VI.1983, rocky river bed and large boulders (DLPC); Bangalore, 1.VI.1984, rock face (DLPC).

*Ecology*.—The adults found on rock faces or large boulders at elevations between 500 and 2000 m. Reportedly predaceous on flying termites (Fowler, 1912).

### *Cicindela (Jansenia) sandurica*, new species

*Diagnosis*.—Distinguished by the small body size; dominant purple-red elytral color without a medial greenish yellow stripe; large elytral spots; pronotum with abundant lateral setae; pronotal margins and proepisterna coarsely wrinkled.

*Description*.—*General habitus*. (Fig. 24, Frontispiece). Body small (8–10 mm); head and pronotum brilliant copper-red with metallic blue lateral margins and depressions; elytra dull, uniformly copper-red on disc extending to the lateral margin and interrupting a lateral blue band, maculae as two large, circular spots one behind the other medially on apical half; body metallic purple, black and blue-green

ventrally with large areas of decumbent setae. *Head*. Mandibles symmetrical distad basal molar on each sex with four large teeth; labrum shiny metallic red, purple or green, surface rough and uneven, flattened with only a broad medial carina, six to ten setae, most submarginal but one or two medially on carina, long and quadrate with only two lateral teeth on each sex, anterior margin rounded on female, concave or slightly wavy on male; frons and vertex with coarse rugae forming an irregular pattern of wavy ridges medially but rugae form generally parallel ridges adjacent to large bulging eyes; surface glabrous. *Prothorax*. Pronotal disc glabrous, lateral and anterolateral margins with many appressed setae; shape globose, with deeply impressed anterior and posterior transverse sulci and a minute bulge at posterior angle, sulci broadly purple and green in contrast to copper disc; pronotal surface coarsely scabrous on disc with lateral margins, anterior and posterior reflexed margins moderately impressed, irregularly wrinkled; proepisterna shiny black, with moderately impressed, irregular wrinkles forming parallel grooves dorsally on male, whereas surface smooth on female, and with sparse setae originating from small setigerous punctures over most of the surface on each sex; prosternum with a shallow, transversely wrinkled surface, glabrous. *Pterothorax*. Male mesepisterna shallowly wrinkled, shiny, long decumbent setae along posteroventral margin; female mesepisterna glabrous, coupling sulcus a deep pit above middle toward posterior margin. *Elytra*. Uniformly dull copper-red on disc and extending to side margin on middle third; iridescent blue suture; a lateral blue iridescence interrupted broadly anterior to middle; two large circular spots in a row on apical half, anterior spot located medially, posterior one touching lateral blue iridescence; elytral disc slightly granulate-punctate, most punctures small, some larger ones basally, punctures shallower and sparser apically; humeral area with large, dense punctures; apices finely microsculptate; sutural spine small, acute; apical margins gradually and separately rounded. *Abdomen*. Sterna laterally with large areas of moderate decumbent setae obscuring surface on anterior five on female and all six on male, medially glabrous on both sexes. *Legs*. Trochanters nonmetallic pitchy black, one subapical seta on each front and middle segment; femora metallic crimson, blue, green and purple except for a black distal end; tibiae and tarsomeres purplish black and blackish green. *Male genitalia*. Aedeagus slender, slightly bulky, widest at middle and tapering gradually on apical third; apex elongate, slightly displaced to the right side and lacking a hook.

*Body size*.—*Holotype*. Body length 8.5 mm, elytral width 3.0 mm. *Allotype*. Body length 9.2 mm, elytral width 3.2 mm.

*Type locality*.—Sandur, Bellary District, Karnataka, India.

*Type specimens*.—*Holotype*, male, labelled "INDIA: Karnataka, 10 km SW Sandur, 13.VII.1986, D.L. Pearson; large boulders"; "HOLOTYPE, *Cicindela sandurica*, Acciavatti & Pearson" [typed and handprinted red label]. *Allotype*, female, and two paratypes labelled similarly to holotype. One additional paratype labelled "INDIA: Karnataka, Sandur, 20.VI.1984, D.L. Pearson; scrub forest floor."

*Type depository*.—*Holotype* and *allotype* to NMNH; 1 paratype to CMNH; 2 paratypes to DLPC.

*Distribution*.—(Fig. 51). Known only from the type locality in east central Karnataka, India.

*Ecology*.—Adults found on large boulders in scrub forest during June and July.

*Etymology*.—This species name is the feminine singular adjectival form of the type locality name, Sandur.

### *Cicindela (Jansenia) motschulskyana* Horn

*Cicindela motschoulskyi* Horn, 1893:198 (preoccupied, Beuthin, 1892:377).

*Type status*. *Holotype*, female! [by monotypy]. *Type depository*. *Holotype* at DEI. *Type locality*. "Indes Oriental" (India).

*Cicindela motschulskyana* Horn, 1915:289 (replacement name).

*Cicindela mostchulskyi* (sic) Horn: Heynes-Wood and Dover, 1928:102.

*Jansonia motschulskyana* (Horn): Rivalier, 1961:135.

*Diagnosis*.—Distinguished by the dull copper elytra with two large, dull, irregular black areas on its disc; surface immaculate except for an inconspicuous dot at outer apical angle.

*Description.*—*General habitus.* Body small to medium (9–10.5 mm); head and pronotum shiny copper dorsally and green laterally; elytra dull copper with two dull black areas on disc, nearly immaculate except for an inconspicuous dot at outer apical angle, lateral margins shiny purple, green and copper; body copper, abdomen bluish black ventrally. *Head.* Mandibles symmetrical distad basal molar, male with four acute teeth coequal in size, female with three large, acute teeth and a small fourth tooth between first and second; labrum long, broad medial carina, testaceous except for dark anterior margin, eight to ten submarginal setae (a few at anterior part of carina); labrum tridentate, female teeth prominent and project ventrad, male teeth small and indistinct. *Prothorax.* Pronotal surface coarsely rugose forming a radiating pattern posteriorly on disc; pronotum glabrous except for several setae along anterior margin at the sides; proepisterna smooth and shiny copper, covered by large, setigerous punctures. *Pterothorax.* Female mesepisternal coupling sulcus a shallow, circular pit near middle of posterior margin; metepisterna shiny copper-purple, coarsely wrinkled and covered by sparse, appressed setae. *Elytra.* Surface dull copper with shiny blue-green to purple lateral margins not attaining suture apically; disc with two irregular, dull black areas which contain a few to many shallow, iridescent spots and setigerous punctures; elytral punctures quite deep basally becoming moderately deep around dull discal areas and shallow wide iridescence apically; subsutural row of foveae somewhat obscured by iridescence of surface although each surrounded by a large, iridescent copper-green area; one subapical spot near outer apical angle; apices finely microserulate, sutural spine absent, margins evenly and separately rounded on each sex. *Abdomen.* All sterna bluish black and covered by fine hairs and numerous appressed setae laterally. *Legs.* Trochanters nonmetallic reddish brown, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic copper. *Male genitalia.* Aedeagus slender, widest at middle, uniformly and gradually tapering to a blunt rounded apex slightly displaced to the right and lacking a hook.

*Distribution.*—(Fig. 52). Southwestern India (Karnataka, southern Maharashtra).

*Localities.*—INDIA: Karnataka: Chikmagalur, 1230 m, V.1982 (CMNH); 14 km E Dandeli, 700 m, 12.VI.1984, road cut (DLPC); 20 km W Shimoga, 11.VI.1985, scrub forest floor (DLPC); 50 km W Dharwar, 18.VII.1986, forest path (DLPC); Maharashtra: 5 km W Ajra, 16.VII.1986, forest path (DLPC).

*Ecology.*—Adults frequent road cuts near open steep slopes and scrub forest from 700 to 1100 m during May, June and July.

### *Cicindela (Jansenia) indica* Fleutiaux

*Cicindela indica* Fleutiaux, 1893b:484.

*Type status.* Lectotype, female [here designated]. *Type labels.* “Inde” [handscript]; “*Cicindela indica* Fleut. co-type, collection FLEUTIAUX” [first line handscript, second typeset on label with a thin black border]; “Syntypus” [typeset red]; “EBERSWALDE, DEI” [typeset]; “LECTOTYPE, *Cicindela, indica* Fleutiaux, by R.E. Acciavatti, ‘84” [typed and handprinted red label]. [Lectotype is 7 mm; missing both antennae and all legs except left middle one.] *Type depository.* Lectotype at DEI. *Type locality.* “Inde” (undoubtedly southern India).

*Cicindela indica* Fleutiaux: Fowler, 1912:342, fig. 152.

*Jansonia indica* (Fleutiaux): Rivalier, 1961:135.

*Nomenclatural note.*—The following published name has been attributed to this species: *dolens* Chaudoir, 1865:23; however, because Chaudoir neither described nor illustrated this species, the name is unavailable.

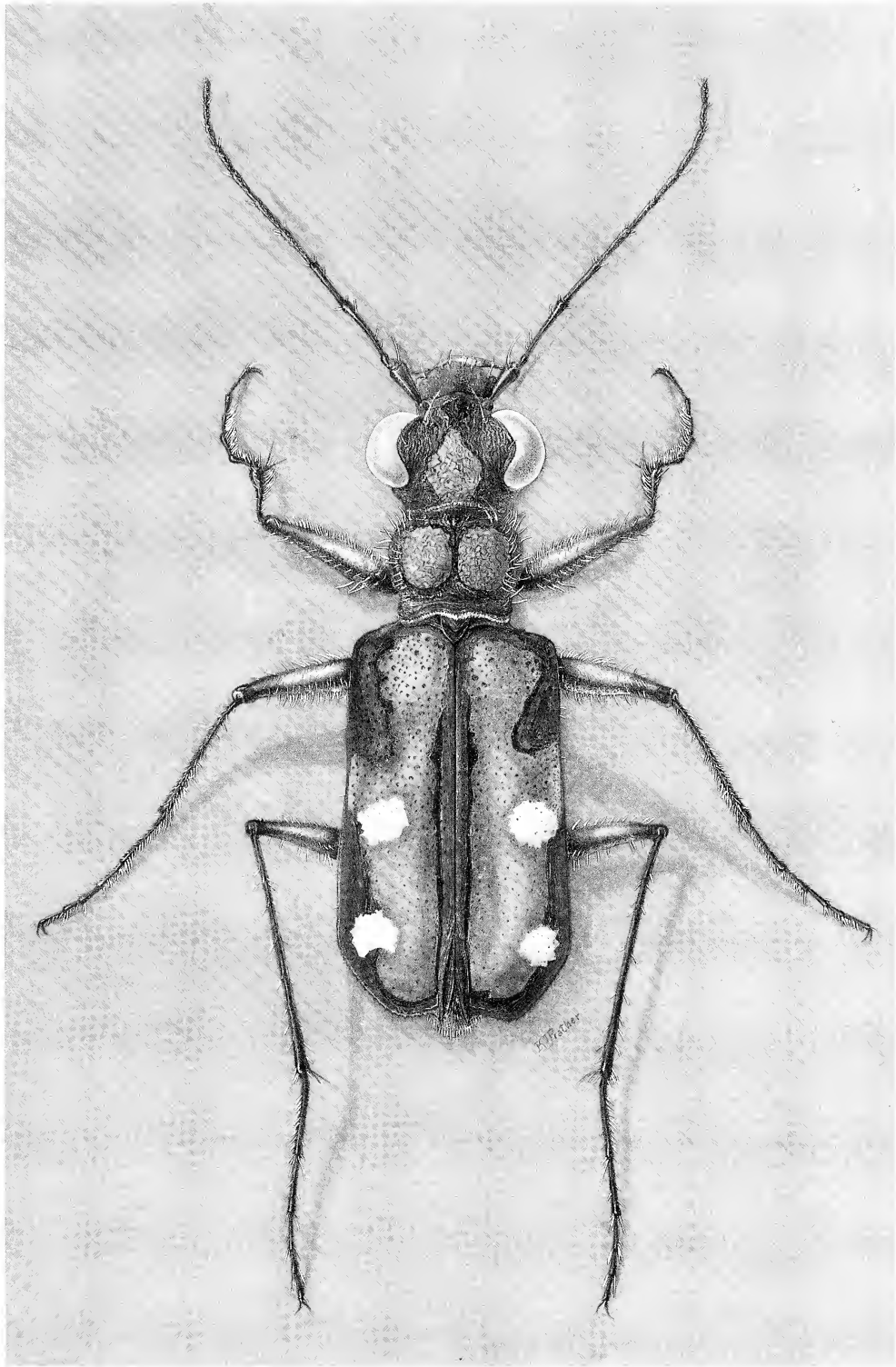
*Diagnosis.*—Distinguished by the metallic labrum; immaculate elytra; elytral surface dull with numerous, small impunctate areas.

*Description.*—*General habitus.* Body small (7–8 mm); head and pronotum coarsely rugose and shiny black on disc, laterally bright dark purple and blue; elytra immaculate, laterally bright copper, medially

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Fig. 24.—Frontispiece.—*Cicindela (Jansenia) sandurica*, new species, male holotype from Sandur, Bellary District, Karnataka, India. (Body size, 8.5 mm.)







slightly less shiny bronze nearly black with irregular impunctate, shiny, raised and velvety black areas on disc, laterally these are mixed with dense punctures basally and shallow punctures apically; ventrally body shiny black. *Head*. Mandibles symmetrical, male with four acute teeth coequal in size distad basal molar, female with three large, acute teeth and a small fourth tooth between first and second from basal molar; labrum long, metallic copper; single medial tooth on female, broadly truncated and minute medial tooth on male; eight to ten setae mostly submarginal, one or two near middle; frons and vertex coarsely rugose; numerous straight and wavy mostly parallel ridges between eyes and vertex midline; eyes bulge slightly dorsally; genae glabrous. *Prothorax*. Pronotum with coarse wavy rugae, entirely glabrous; proepisterna with slightly raised wrinkles and almost entirely glabrous except for a few setae near procoxae; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a small pit moderately deep to elongate above middle toward posterior margin. *Elytra*. Immaculate; medial and lateral surfaces appearing rough and uneven from large, irregular and smooth, shiny raised areas, basally with large, dense punctures, apically nearly impunctate with contrasting iridescent colors appearing in numerous broad and shallow depressions; one to three small dull velvety black discal areas poorly defined and irregularly shaped, often narrowly joined along suture; microsculptulations small; apical margins rounded, reflexed at extreme tip mesad suture; sutural spine small. *Abdomen*. Sterna on most specimens sparsely setose, lateral surface of anterior two sterna with longitudinal ridges. *Legs*. Trochanters nonmetallic pale testaceous, one subapical seta on each front and middle segment; femora metallic copper-green except for a short pale portion at distal end; tibiae and tarsomeres dark brownish black, nonmetallic. *Male genitalia*. Aedeagus moderately bulky, widest at middle third, tapering evenly and abruptly on apical third to a short, acute apex with a small sclerotized bead, lacking a hook and only slightly displaced to the right.

*Distribution*.—(Fig. 53). West central India (Maharashtra).

*Localities*.—INDIA: Maharashtra: Thane District, 10 km W Thane, 28.VI.1985, forest path (DLPC, CMNH); Matheran, 800 m (DEI); 12 km S Panvel, 29.VI.1985, 30 m, forest path (DLPC, CMNH); 5 km W Ajra, 16.VII.1986, forest path (DLPC); 20 km E Savantvadi, 16.VII.1986, forest path (DLPC).

*Ecology*.—Adults are found along paths and road cuts within forests.

### *Cicindela (Jansenia) reticulella*, new species

*Diagnosis*.—Distinguished by the metallic labrum; immaculate elytra; shiny, irregularly raised areas apically on elytra; female body nearly glabrous ventrally, male body sparsely setose ventrally; female mesepisternal coupling sulcus a small shallow dorsal pit.

*Description*.—*General habitus*. (Fig. 25). Body small (7–8 mm); dorsum black, slightly shiny, sides shiny purple or black; head and pronotum dorsally with coarse rugae creating an irregular network of raised ridges; elytra immaculate; lateral elytral margin shiny polished bronze, disc shiny and polished bronze-black with one or two small irregular impunctate areas medially; body black ventrally; male body glabrous except for sparse setae laterally on abdomen, female body glabrous. *Head*. Mandibles symmetrical distad basal molar, male with four acute teeth coequal in size, female with three large, acute teeth and a small fourth tooth between first and second from basal molar; labrum metallic copper, longer than wide; female labrum with one medial tooth, male with labrum anterior edge broadly truncated; six to eight labral setae, mostly submarginal, but a few toward middle; vertex of head with network of coarse, irregular rugae between eyes, rugae irregular at middle, nearly parallel adjacent to eyes which bulge slightly dorsally; genae glabrous. *Prothorax*. Pronotum with coarse rugae forming an irregular network of parallel and arcuate ridges on disc; pronotal surface glabrous; proepisterna with wavy wrinkles and glabrous; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a small shallow pit at posterior margin; metepimera glabrous on female and sparsely setose on male; metasternum almost entirely setose on female and sparsely setose on male. *Elytra*. Immaculate, lateral margin shiny bronze, disc shiny and polished bronze-black; one or two small irregular impunctate areas only medially intermixed with large, deep punctures two to four of which often coalesce within a shallow elongate depression; small, narrow blue punctures on apical third of elytral disc; elytral apex microsculptate; apical margins rounded; sutural spine small. *Abdomen*. Sterna laterally glabrous on each sex, most female specimens with few hairs and long primary setae medially on each of second to fifth sterna, male with more setae; first to third sterna laterally with longitudinal straight and wavy ridges. *Legs*. Trochanters pale testaceous, one subapical seta on each front and middle segment; femora metallic copper-green except for a pale area distally; tibiae and tarsomeres nonmetallic, pale to dark brownish black. *Male genitalia*. Aedeagus moderately bulky, widest at middle

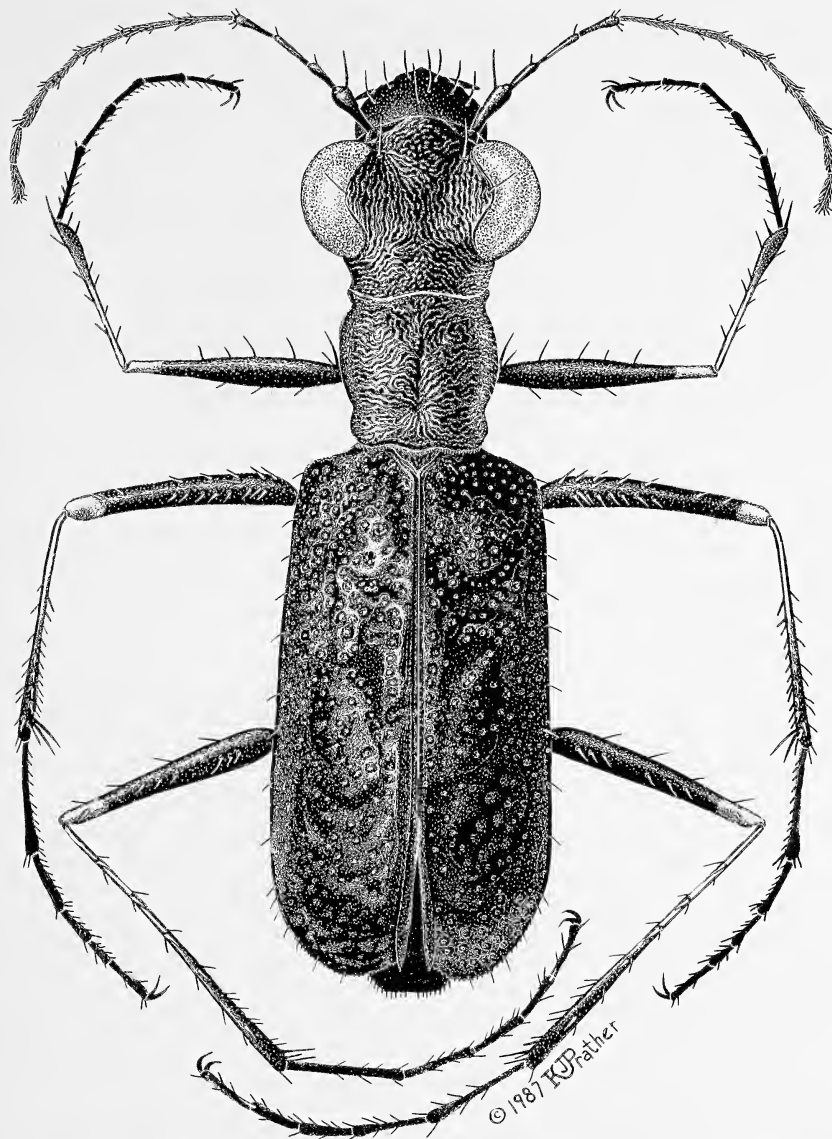


Fig. 25.—*Cicindela (Jansenia) reticulella*, new species, male holotype from Kadra Jungle, North Kanara District, Karnataka, India. (Body size, 7.2 mm.)

third, then tapering abruptly to a short acute lightly sclerotized apex, not hooked, and only slightly displaced to the left side in left lateral aspect.

*Body size.*—*Holotype*. Body length 7.2 mm, elytral width 2.4 mm. *Allotype*. Body length 7.9 mm, elytral width 2.7 mm.

*Type locality.*—Kadra Jungle, Kanara District, Karnataka, India.

*Type specimens.*—Holotype, male, pinned with a minute needle through cardboard and labelled “Kadra jungle, 6.6.09” [handprinted in pencil on underside]; “S. India, Kanara, T.R. Bell, B.M. 1934-394” [typeset]; “*C. umbropolita*, W.

Horn, Dr. K. MANDL det. 1980" [handprinted pencil and typeset]; "Cicindela, indica, Fleutiaux, det. R.E. Acciavatti, '83" [handprinted and typed]; "HOLOTYPE, Cicindela, reticulella, Acciavatti & Pearson" [typed and handprinted red label]. Female allotype, 22 paratypes with same label data, except collected between 4–7.VI.1909. Two additional paratypes labelled "India: Goa, 56 km E Panaji, 17.VII.1986, D.L. Pearson; forest path" [typeset].

*Type depository.*—Holotype, allotype and 13 paratypes at BMNH. Remaining paratypes distributed as follows: 4 to CMNH; 3 to DLPC; 1 each to FCC, RLHC, HSC, and NMNH.

*Distribution.*—(Fig. 53). Southwestern India (Goa, western Karnataka).

*Ecology.*—Adults were collected within jungle forests during June and July.

*Etymology.*—This feminine singular species name is derived from the Latin *reticul* (network) and *-ella* (a diminutive suffix) with reference to the irregular network of moderately raised rugae on the head and pronotum.

### *Cicindela (Jansenia) tetragrammica* Chaudoir

*Cicindela tetragrammica* Chaudoir, 1865:58.

*Type status.* Syntype(s)? [unexamined; concept based on comparison of its original description with specimens! from Peermade, Kottayam District, Kerala, India, at CMNH]. *Type depository.* ?MNHN. *Type locality.* "Malabar Coast" (Kerala, India).

*Cicindela tetragrammica* Chaudoir: Fowler, 1912:331, fig. 147.

*Jansonia tetragrammica* (Chaudoir): Rivalier, 1961:135.

*Diagnosis.*—Distinguished by the roughened metallic labrum with numerous medial as well as submarginal setae; elytra with numerous small copper foveae and large circular metallic greenish blotches scattered over the black disc; large and prominent eyes; sparsely setose genae on most specimens.

*Description.*—*General habitus.* Body medium (10–13 mm); head and pronotum dull, nearly black, most specimens shiny copper, a few others with greenish reflections; elytra dull, velvety black, slightly copper or green metallic at humeral angle and lateral margin, mostly impunctate with numerous small green and copper flecks and many small copper foveae associated with large circular metallic greenish blotches throughout the entire disc, two large circular spots medially in a row; body shiny copper, blue and greenish black ventrally. *Head.* Mandibles symmetrical distad basal molar, four large acute teeth on both sexes; labrum metallic, rough and wrinkled; six to ten mostly submarginal setae, several scattered along broad medial carina; female labrum long, tridentate (middle tooth largest) along anterior edge; male labrum short tridentate, teeth small, anterior edge wavy; penultimate segment labial palpi light tan, terminal segment metallic purple or green; frons and vertex glabrous, rugae straight and wavy; eyes large and prominent; genae on most specimens sparsely setose, glabrous on a few others (refer to geographic variation). *Prothorax.* Pronotum moderately rugose; deep anterior and posterior transverse sulci; broad, transversely wrinkled anterior and posterior reflexed margins; long, appressed irregularly placed setae on lateral pronotal margin; proepisterna shiny copper-black and smooth except for long appressed setae originating from small setigerous punctures and scattered over all but the dorsal margin; long, erect setae scattered over much of prosternum. *Pterothorax.* Mesepisterna shiny and smooth, only slightly wrinkled, sparse appressed setae ventrally; female mesepisternal coupling sulcus a shallow, medial pit or cavity. *Elytra.* Surface mostly impunctate; numerous small greenish and copper flecks, many irregularly spaced and small copper foveae and large, circular, metallic greenish blotches scattered throughout the entire disc; elytral foveae and punctures deepest basally; two large, circular yellow spots one behind the other medially on apical half; microsculptulations small; sutural spine small, acute; apical margins straight from outer apical angle to just before apex, margins gradually rounded at suture. *Abdomen.* Anterior five sterna on female and all six on male with abundant, long setae laterally, medially glabrous. *Legs.* Trochanters pitchy black, on some specimens metallic tinged, one subapical seta on each front and middle segment; femora and tibiae metallic copper and green-black; tarsomeres black and purple. *Male genitalia.* Aedeagus broad, widest on middle third, tapering abruptly to a short broad hookless apex.

*Geographic variation.*—The sparse, ventral setae on the genae are absent on 2 of 31 specimens! from Peermade, Kerala, on 1 of 6 specimens! from Cinchona, Tamil Nadu, and on all 3 specimens! from the Nilgiri Hills, Tamil Nadu.

*Distribution.*—(Fig. 51). Southern India (Karnataka, Kerala, western Tamil Nadu). Records from Maharashtra (Heynes-Wood and Dover, 1928) are doubtful.

*Localities.*—INDIA: Tamil Nadu: Madurai District, Coimbatore District, Nilgiri Hills, Naduvattam, 1845 m, VII.1950 (CMNH); Cherangode, 1075 m, V.1950 (CMNH); Anaimalai Hills, Cinchona, 1075 m, V.1976 (CMNH); 25 km S Pollachi, 18.VI.1983, forest path (DLPC); Kerala: Kottayam District, Peermade, 1290 m, V.1975 (CMNH); Periyar, 1000 m, 15.V.1984, forest path (DLPC); Quilon District, Tenmali, 170 m, V.1985 (CMNH).

*Ecology.*—Adults occur on the floor of shrubby secondary forest and sandy roads through scrub forest.

*Cicindela (Jansenia) applanata*, new species

*Diagnosis.*—Distinguished by the roughened metallic labrum with numerous medial and submarginal setae; elytra with numerous small, copper foveae and large, circular, metallic greenish blotches scattered over the black disc; flattened vertex, small less protruding eyes; glabrous genae.

*Description.*—*General habitus.* (Fig. 26). Body small to medium (9.5–11 mm); head and pronotum dull, nearly black, on most specimens copper, some specimens shiny green laterally; elytra dull black with copper or green metallic humeral angle and lateral margin, mostly impunctate with numerous small green and copper flecks and copper foveae associated with many large, circular, metallic green blotches scattered throughout the entire disc, basally punctures and foveae are densest and deepest; elytra marked with two large, oval, yellow spots medially one behind the other; body shiny copper, blue and green-black ventrally; long setae scattered over much of ventral surface. *Head.* Mandibles symmetrical, four large acute teeth distad basal molar on each sex; most of male mandible ivory but teeth darkened, female mandible on basal half ivory, distal half darkened; labrum metallic, surface rough and wrinkled; six to ten setae, most submarginal, several scattered along most of the broad, medial carina; female labrum long tridentate (middle tooth largest) along anterior edge; male labrum short tridentate, teeth small, anterior edge wavy; labial palpi with penultimate segment light tan, terminal segment metallic purple or green; clypeus wrinkled, glabrous; frons and vertex (except for a pair of supraorbital setae) glabrous, rugae wavy medially and straight adjacent to eyes; vertex flattened, eyes small, not protruding laterally; genae glabrous, rugae parallel. *Prothorax.* Pronotum scabrous with anterior and posterior transverse sulci deep, anterior and posterior reflexed margins with irregular rugae; laterally pronotum with long, appressed setae, irregularly placed along entire margin; proepisterna shiny copper-green with shallow parallel wrinkles along the glabrous dorsal margin, remainder of surface with sparse, long appressed setae originating from small setigerous punctures; prosternum with long, erect setae scattered over much of the surface. *Pterothorax.* Mesepisterna with a shiny, smooth surface and sparse appressed setae scattered over its ventral surface; female mesepisternal coupling sulcus on most specimens a broad indefinite groove, on a few specimens a shallow dimple along posterior margin. *Elytra.* Surface dull, velvety black with slightly copper or green metallic humeral angles and lateral margin; numerous and irregularly spaced small copper foveae associated with large, circular, metallic greenish blotches throughout the entire disc; two large oval yellow spots medially in a line on the apical half; apices with small microserrulations; sutural spine small and acute; apical margins evenly and separately rounded. *Abdomen.* Anterior five sterna on female and all six on male with abundant, long setae laterally, medially glabrous. *Legs.* Trochanters pitchy black, some specimens metallic tinged, one subapical seta on each front and middle segment; femora and tibiae metallic copper and green-black; tarsomeres black and purple. *Male genitalia.* Aedeagus broad, widest at middle, tapering gradually and drawn out to a long acute apex lacking a hook.

*Body size.*—*Holotype.* Body length 10.6 mm, elytral width 4.1 mm. *Allotype.* Body length 9.7 mm, elytral width 3.7 mm.

*Type locality.*—Kodaikanal, Palni Hills, Madurai District, Tamil Nadu, India.

*Type specimens.*—Holotype, female, labelled "INDIA: Tamil Nadu, Madurai District, Kodaikanal, 7000 ft, Palni Hills, V.1983, T.R.S. Nathan, leg."; "HO-

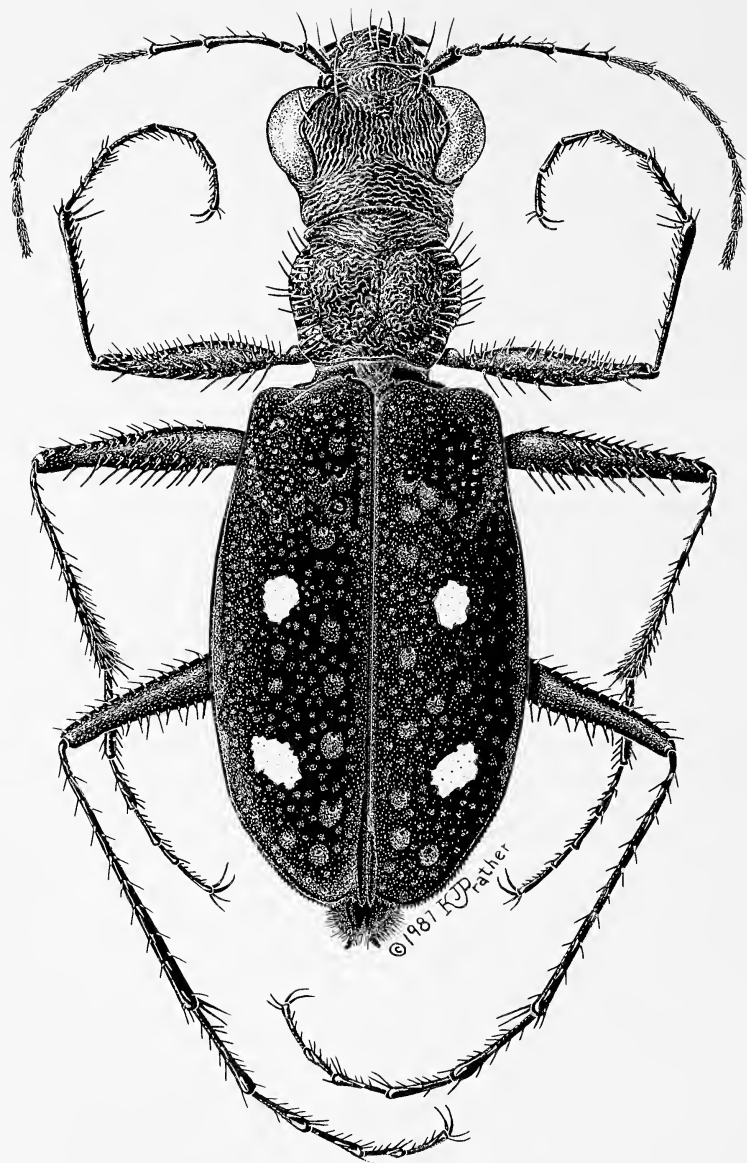


Fig. 26.—*Cicindela (Jansenia) applanata*, new species, female holotype from Kodaikanal, Palni Hills, Madurai District, Tamil Nadu, India. (Body size, 10.6 mm.)

LOTYPE, *Cicindela, applanata*, Acciavatti & Pearson" [typed and handprinted red label]. Male allotype, 12 paratypes labelled same as holotype. An additional 28 paratypes from the following localities: "Mts. Kodaikanal, 6500 ft; Kodaikanal, ca. 7500 ft, Palni Hills"; "Shembaganur, Madura"; "Vembadi Hill, ca. 8000 ft"; "Kodaikanal, Pulneys, 4 to 15.V.19."

*Type depository*.—Holotype, allotype and 9 paratypes at CMNH. Remaining 31 paratypes distributed as follows: 7 to DEI; 5 to ZIL; 10 to MCZC; 2 each to JWC, DLPC, and EGC; 1 each to ZSI, IRSNB, and RHLG.

*Distribution.*—(Fig. 51). India (west central Tamil Nadu). In addition to the type material, specimens! from “Trichinopoly” (Tiruchchirappalli, Tamil Nadu, India) (DEI), “Pondicherry” (Union Territory enclave in Tamil Nadu, India) (DEI), and “Walajanagar, North Arcot” (District, Tamil Nadu, India) (RDWC). A single specimen! at DEI labelled “Bombay” (northeast Maharashtra, India) is likely mislabelled.

*Ecology.*—The habitat is unreported for this species but its adults probably occur in open forests. They are active during May and June at elevations above 2200 m.

*Etymology.*—This name is feminine singular and derived from the Latin *applanat* (flattened) with reference to the shallowly excavated vertex of the head and the small eyes not protruding laterally.

*Remarks.*—*Cicindela applanata* superficially resembles *C. tetragrammica*, but is slightly smaller with less prominent eyes and lacks sparse ventral setae on the genae. Differences for the female coupling sulcus and shape of the apex of the male genitalia indicate that the two species are distinct.

### Subgenus *Cicindela* (*Glomera*), new subgenus

Type species.—*Cicindela belloides* (Horn, 1907), new combination; fixed here.

*Diagnosis.*—*Cicindela* (*Glomera*) species adults are distinguished from those of related subgenera by these characters: 1) male aedeagus internally with flagellum forming five tight coils on the left side of the inner sac in left lateral aspect but without small basal stiffening rib; adults of all other subgenera with similar general habitus have a loosely spiralled flagellum coiled from one to several times within the male aedeagus internal sac lying medially on the left lateral aspect with a consistently present small stiffening rib; 2) male aedeagus short, bulbous, abruptly enlarged and very wide on basal third, remaining two-thirds nearly conical; males of other subgenera have a more uniformly tapering aedeagus; 3) body size very small; adults of this subgenus represent the smallest species of Indian subcontinent tiger beetles; 4) body shiny blackish bronze, head with finely raised rugae forming 13 to 18 mostly complete ridges between each eye and vertex midline, finely rugose in parallel and irregular patterns on pronotal disc; other species of similar habitus possess more coarsely rugose head and pronotum sculpturing and fewer complete ridges adjacent to each eye; 5) body setae entirely absent or restricted to certain areas on thoracic and abdominal sterna; subglabrous habitus shared by only a few other species; 6) labrum dull bronze metallic, six to eight submarginal setae, one medial tooth large on female, inconspicuous on male, medial ridge broad; metallic labrum on other species varied, one to five toothed often with sinuate anterior margin and abrupt medial carina; 7) elytra immaculate, smooth, shiny copper-green lateral margins and wide glossy purple-black band extending along margins sublaterally and projecting mesad to middle of disc as two rounded projections; elytra on all other immaculate species rough and irregularly sculptured; 8) femora pale, testaceous with a slightly darker distal end; tibiae and tarsomeres brown testaceous; opaque or metallic on most other species with similar habitus.

*Etymology.*—This feminine name is derived from the Latin *glomeratus* (wound into a ball) with reference to the numerous tight coils of the male genitalic flagellum for the type species.

*Remarks.*—*Cicindela* (*Glomera*) represents a grouping of two species divergent from those of several currently recognized subgenera, *Cicindela* (*Setinteridenta*), *Cicindela* (*Oligoma*), and *Cicindela* (*Ifasina*). Comparison with all known Indian



subcontinent species of these subgenera indicate the two *Cicindela* (*Glomera*) species have male genitalia and external adult characters basically different from those of any known *Cicindela* (*sensu lato*) subgenus. The differences were deemed sufficient to justify subgeneric ranking.

*Included species.*—Two species from southern India comprise *Cicindela* (*Glomera*): *C. (G.) belloides* (Horn, 1907), new combination; *C. (G.) ochrocnemis*, new species.

#### Key to adults of *Cicindela* (*Glomera*) species

1. Body entirely glabrous on thoracic sterna, only finely setose on abdominal sterna; wide glossy purple-black elytral lateral margin extending from humeral angle to suture ..... *belloides* (Horn), new combination
- Body with areas of appressed and semierect setae on thoracic and abdominal sterna; wide glossy purple-black lateral elytral margin extending only from humeral to outer apical angles ..... *ochrocnemis*, new species

#### *Cicindela* (*Glomera*) *belloides* (Horn), new combination

*Prothyma belloides* Horn, 1907b:311.

*Type status.* Three male syntypes [unexamined; concept based on its original description, the account and illustration by Fowler (1912) compared with specimens! labelled "India, Karnataka, Jog Falls, 10.VI.1985, forest path" at CMNH]. *Type depository.* One male syntype at DEI (Döbler, 1973); unexamined. *Type locality.* "Ind. or., Kanara bor., Basti" (North Kanara, Karnataka, India).

*Prothyma belloides* Horn: Fowler, 1912:309, fig. 140.

*Nomenclatural note.*—This species is not a member of the genus *Prothyma* as Horn thought when he described it; later, he realized it differed from other members of that genus (Fowler, 1912). Rivalier (1964), who was not familiar with this species, omitted it during his revision of the *Prothyma*. Nonetheless, from the information he provided about the aedeagal structures, *Cicindela belloides* does not agree with the generic characters of that genus.

*Diagnosis.*—Distinguished by the immaculate elytra with wide glossy purple-black lateral margins projecting mesad and extending from humeral angle to suture; proepisterna entirely glabrous.

*Description.*—*General habitus.* Body very small (5.5–6 mm); body slightly robust; head and pronotum black, bronze or copper dorsally, blue-green laterally and purple at margin; elytra immaculate with broad and diffuse shiny copper-green band mesad of a wide glossy purple-black lateral margin extending from humeral area to suture and projecting to middle of disc as rounded basal and medial projections; body almost entirely glabrous except for setose coxae and fine hairs ventrally on abdomen. *Head.* Labrum long, middle broadly raised, surface shiny metallic black to copper, five to eight submarginal setae; female with one medial tooth, but male with a minute tooth and anterior margin slightly concave; frons with fine transverse rugae; 13 to 18 mostly complete, slightly raised longitudinal ridges between each eye and vertex midline; rugae much finer and arcuate medially; eyes large and bulging; clypeus, vertex and genae glabrous. *Prothorax.* Pronotum glabrous, finely rugose; rugae forming irregular pattern laterally on disc, parallel along medial line and at lateral edge; proepisterna shiny black with parallel wrinkles on dorsal third, entirely glabrous; prosternum glabrous. *Pterothorax.* All sclerites glabrous; female mesepisternal coupling sulcus a shallow, circular pit medially. *Elytra.* Surface shiny, bronze to copper black dorsally, surface covered by small, green punctures, deepest and most numerous basally becoming more shallow and sparser apically; elytra immaculate; broad and diffuse shiny copper-green band mesad of wide purple-black lateral margin extending from humeral area to suture and projecting mesad to middle of disc as rounded projections on basal and middle thirds of elytra; apex finely microserulate; sutural spine small. *Abdomen.* Anterior three sterna glabrous laterally with intervening sutures poorly defined and slightly connate at lateral margin, sterna two and three obviously connate medially; all visible sterna medially covered by sparse, fine hairs, sterna three to



five with a pair of long primary setae at posterior margin; sixth male sternum broadly notched medially. *Legs*. Trochanters nonmetallic pale testaceous, subapical seta on each front segment, middle segments glabrous; femora pale testaceous except for a sooty black portion at extreme distal end; tibiae and tarsomeres sooty black. *Male genitalia*. Aedeagus very short and bulbous, enlarged abruptly on basal third and very wide at middle, almost conical on apical third where it tapers gradually to a blunt, rounded point with a small, sclerotized beak at apex slightly displaced to the right; apical orifice rigidly and widely open below apical beak.

*Distribution*.—(Fig. 54). Western Karnataka, India.

*Localities*.—INDIA: Karnataka: Jog Falls, 550 m, 10.VI.1985 and 10.VI.1987, forest path (CMNH, DLPC).

*Ecology*.—Adults have been collected within forests during June.

*Cicindela (Glomera) ochrocnemis*, new species

*Diagnosis*.—Distinguished by the lateral elytral margin shiny iridescent with a wide glossy black edge projecting mesad and extending from humeral angle only to outer apical angle; sparse setae ventrally on proepisterna.

*Description*.—*General habitus*. (Fig. 27). Body very small (6–6.5 mm); body slightly robust; head and pronotum shiny and bronze dorsally, slightly bluish black and purple laterally; elytra immaculate, disc dull black, laterally with shiny purple, blue or copper iridescent margins projecting as two medial lobes onto disc, glossy black band at lateral edge; body black to greenish black ventrally. *Head*. Labrum short, dull metallic bronze; six to eight submarginal setae; one large medial tooth on females, tooth inconspicuous on males, medial ridge broad; frons with fine transverse rugae medially and with longitudinal rugae laterally, rugae extend onto vertex; 15 to 18 mostly complete, moderately raised longitudinal ridges between each eye and vertex midline, ridges arcuate medially; eyes bulging; genae glabrous. *Prothorax*. Pronotum entirely glabrous with finely raised rugae forming an irregular pattern laterally on disc but aligned in parallel along medial line and at lateral edge, and transversely on anterior reflexed margin; proepisterna shiny black, dorsally glabrous with shallow wrinkles, ventrally with scattered setae originating from small punctures; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a shallow, circular dimple medially. *Elytra*. Immaculate; elytral disc dull black, small noncontrasting punctures deepest basally almost impunctate apically; lateral elytral margins broadly shiny purple, blue or copper iridescent from humeral angle to outer apical angle but not reaching suture; two narrow projections both infused with black from lateral edge extending mesad nearly to middle of disc, the anterior one small and the posterior one sinuate; elytral apex finely microsculptate; sutural spine small. *Abdomen*. Sterna covered by fine hairs, scant appressed setae scattered on a few male specimens laterally, absent on females. *Legs*. Trochanters pale testaceous nonmetallic, one subapical seta on each front segment, seta inconspicuous on each middle segment on most specimens and entirely lacking on some specimens; femora pale, testaceous with a slightly darker distal end; tibiae and tarsomeres brown testaceous. *Male genitalia*. Aedeagus bulbous, abruptly enlarged and very wide on basal third, remaining two-thirds nearly conical, tapering gradually to a blunt, rounded point; small sclerotized beak, not displaced to the right side in left lateral aspect, distad of a rigid and wide apical orifice.

*Body size*.—*Holotype*. Body length 6.2 mm, elytral width 2.0 mm. *Allotype*. Body length 6.5 mm, elytral width 2.2 mm.

*Type locality*.—Bantyal, South Kanara District, Karnataka, India.

*Type specimens*.—*Holotype*, male labelled "INDIA: Karnataka, 35 km NE Bantyal, 5.VI.1984, 200 m, D.L. Pearson; road cut." Female allotype, five paratypes with same label data. Seven additional paratypes from: "INDIA: Karnataka, 75 km W Mudigere, 28.V.1985"; "INDIA: Karnataka, 60 km NE Mangalore, 30.V.1985"; "INDIA: Karnataka, Shimoga District, Agumbe Ghat, 2000 ft, V.1974, T.R.S. Nathan, leg."; "INDIA: Karnataka, Karka (?Karkal), 4.VI.1987, T. Shivashankar, forest floor."

*Type depository*.—*Holotype* at IARI, allotype to NMNH; 8 paratypes to DLPC; 2 paratypes each to UASB and CMNH.

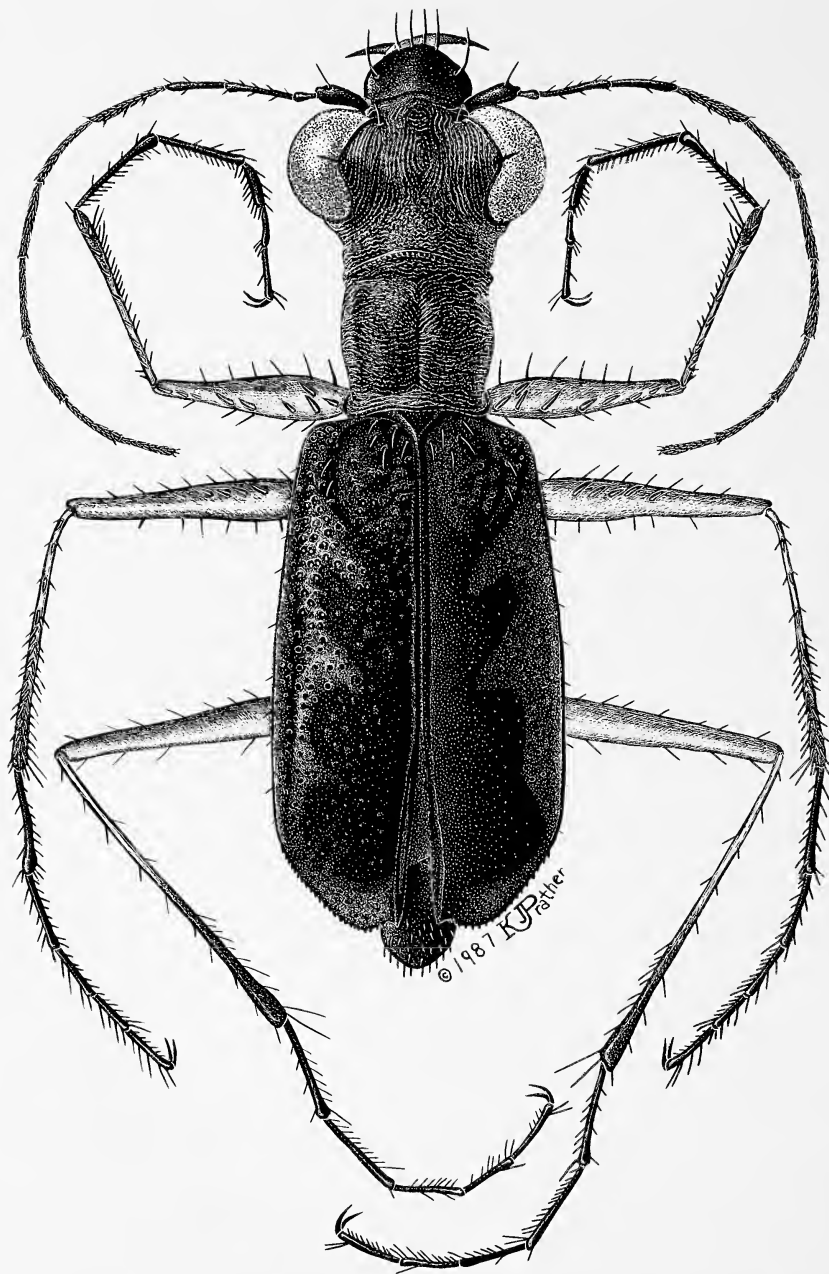


Fig. 27.—*Cicindela (Glomera) ochrocnemis*, new species, male holotype from Bantyal, South Kanara District, Karnataka, India. (Body size, 6.2 mm.)

*Distribution.* — (Fig. 55). Western Karnataka (South Kanara, Shimoga Districts), India.

*Ecology.* — Adults frequent open areas such as road cuts during May and June at low to middle elevations. They have been collected with *C. (Jansenia) prothyroides* on the forest floor.

*Etymology*.—This name is feminine singular and derived by combining the Greek *ochro* (pale yellow) and *cnemis* (legs) with reference to the entirely pale, translucent testaceous legs.

*Remarks*.—*Cicindela ochrocnemis* shares many morphological characters with *Cicindela belloides*, including the bulbous male aedeagus, but differs substantially by the presence of sparse setae on the proepisterna and abdomen, and abundant appressed setae on the pterothorax.

### Subgenus *Cicindela* (*Setinteridenta*) Acciavatti

*Cicindela* (*Setinteridenta*) Acciavatti, 1987:378.

Type species.—*Cicindela rhytidopteroides* Horn, 1924.

*Diagnosis*.—Adults distinguished from those of related subgenera by: 1) a male genitalic capsule broadly truncated and expanded at apex; flagellum forming one spiral in the left lateral aspect; large semisclerotized shield connected to the sclerites at the base of the inner sac; large elongate chitinous tooth free within the genitalic inner sac in right lateral aspect; 2) a long, five-toothed labrum with a wide whitish yellow center, and six anterior setae, the middle four of which originate at the margin between the teeth, and the lateral two are submarginal; 3) elytra with white maculae reduced to two lateral spots, one at the middle and the other at the outer apical angle; 4) front trochanters each with a subapical seta, middle trochanters lacking such setae; 5) a lustrous body, surface of head with large transverse rugae and pronotal sculpturing with fine, irregular wrinkles, almost polished on disc; body ventrally with sparse setae.

*Included species*.—*Cicindela* (*Setinteridenta*) contains one species confined to the northern portions of the Indian subcontinent: *C. (S.) rhytidopteroides* Horn, 1924.

### *Cicindela* (*Setinteridenta*) *rhytidopteroides* Horn

*Cicindela rhytidopteroides* Horn, 1924a:89.

Type status. Lectotype, female! [previously designated (Acciavatti, 1987)]. Type depository. Lectotype at DEI. Type locality. "Bengal" (India).

*Cicindela rhytidopteroides* Horn: Mandl, 1982a:62.

*Cylindera* (*Ifasina*) *rhytidopteroides* (Horn): Naviaux, 1985:73, fig. 26, 61, 92.

*Cicindela* (*Setinteridenta*) *rhytidopteroides* Horn: Acciavatti, 1987:378, fig. 1–4.

*Description*.—*General habitus*. Body very small to small (7–8 mm); body dorsally lustrous, dark bronze with lateral iridescence; two white oval elytral maculae laterally; body dark green to dark blue and purple ventrally. *Head*. Antennal scape with one subapical seta; dorsally dark bronze, laterally iridescent blue-green; labial palpi slender, elongate with only terminal segment metallic, remainder testaceous; labrum long, five toothed, mostly metallic black except for large whitish yellow center; six labral setae, middle four each originating at anterior margin from between teeth, lateral two submarginal; head glabrous on genae, frons and vertex except for two pairs of supraorbital setae; large rugae on frons, transverse medially, arcuate dorsally and laterally, merging with eight to ten mostly complete large longitudinal rugae between each eye and vertex midline. *Prothorax*. Pronotum greenish bronze to copper; pronotal shape laterally distinctively rounded, sides arcuate in dorsal view, transverse rugae on anterior reflexed margin, disc polished with fine irregular and slightly transverse wrinkles, laterally smooth and glabrous, rounded sides; lateral suture not prominent; proepisternum purple, glabrous except for a small setose area at coxal margin; prosternum glabrous. *Pterothorax*. Mesepisternal and metepisternal setae moderately and densely appressed; female mesepisterna coupling sulcus a minute pit dorsally at middle. *Elytra*. Punctures small basally, shallow apically; row of subsutural foveae evident; surface shiny, dark bronze to copper-brown dorsally, broad band of blue-green and purple iridescence laterally from humeral angle to apical suture; two ivory white spots, one on middle and one on apical third near outer apical angle, both distinctly laterad at interior boundary of iridescence, but not touching lateral margin. *Abdomen*. Sparse lateral setae on anterior three sterna. *Legs*. Tro-

chanters dark, one subapical seta on each front segment, middle segments glabrous; femora metallic blue-green; tibiae and tarsomeres metallic purple. *Male genitalia*. Aedeagus widest on middle third, broadly truncated and expanded at apex, ending with a rounded tip displaced to the right side in left lateral aspect (Acciavatti, 1987).

*Distribution*.—(Fig. 51). Found in northern India (West Bengal, Uttar Pradesh) and Nepal.

*Localities*.—NEPAL: Dhading District: Ankhu Khola Valley, Ankhu Sangu to Sellentar, 530 to 750 m, cropland, stream bank/shore, 26.VII.1983 (SMFM); Gorkha District: Darondi Khola below Barpak down to Doreni, 900 to 1100 m, waldreste (cutover forest), 12.VIII.1983 (SMFM, CMNH); Darondi Khola between Doreni and Motar, 750 to 900 m, wald/kulturland (forest/cropland), 12.VIII.1983 (SMFM, CMNH); Myagdi District: Dhawalagiri, Kali Gandaki Khola, Benikusma, 800 to 1000 m, 30.VI–1.VII.1986 (JPC, CMNH); Janakpur, Tamba Koshi Khola, SE Charikot, 900 to 1200 m, 6.VI.1987 (JPC, CMNH). INDIA: West Bengal: Namoo, Darjeeling, 645 m, 18.VI.1918 (BMNH); 15 km N Siliguri, 3.VI.1985, 250 m, grassy meadow (DLPC); Assam/Meghalaya: Gamduani, Goalparai, 5.VI.1971 (ZSI); Assam: Kachugaon, 25.VII.1973 (ZSI); Uttar Pradesh: West Almora Division, Kumaon, VIII.1917 (BMNH).

*Ecology*.—Adults occur on open areas of short grass and sand at low elevations (200 to 1100 m) in forests, fields and croplands.

### Subgenus *Cicindela* (*Oligoma*) Rivalier

*Cylindera* (*Oligoma*) Rivalier, 1961:139.

Type species.—*Cicindela paradoxa* Horn, 1892.

*Cicindela* (*Oligoma*) Rivalier: Acciavatti, 1987:379.

*Diagnosis*.—*Cicindela* (*Oligoma*) species adults are closely related to those of the previous subgenus by the similar adult male spiral flagellum entirely on the left lateral aspect within the genitalic capsule, the presence of a small stiffening rib basally and the similar external appearance of the head and elytral maculae. Acciavatti (1987) showed that adults of the two subgenera could be readily distinguished from one another by: 1) the details within the inner sac, including the number of complete spirals of the flagellum; 2) the placement of the labral setae all submarginally rather than both between the teeth and submarginally.

*Included species*.—Two species from Sri Lanka and southern India comprise *Cicindela* (*Oligoma*): *C. (O.) paradoxa* Horn, 1892; *C. (O.) lacunosa* Putzeys, 1875.

### Key to adults of *Cicindela* (*Oligoma*) species

1. Body surfaces almost entirely glabrous . . . . . *paradoxa* Horn
- Body surfaces covered by abundant appressed setae . . . . . *lacunosa* Putzeys

### *Cicindela* (*Oligoma*) *paradoxa* Horn

*Cicindela paradoxa* Horn, 1892a:75.

*Type status*. Lectotype, male [here designated]. *Type labels*. “Ceylon, \*, Nietner., Mus. Berolin.” [handscript]; “Type!, Dr. W Horn” [typeset lines within a thin black border]; “Syntypus” [typeset red label]; “DEI, EBERSWALDE” [typeset]; “LECTOTYPE, *Cicindela, paradoxa* W. Horn, by R.E. Acciavatti, ’84” [typed and handprinted red label]. [Lectotype is 7.5 mm; missing all appendages but proximal three right antennomeres.] [Horn was ambiguous about the number of males he saw for his original description and the generic placement of this species; because Horn did not definitely mention one specimen in his description and circumstantial evidence indicates familiarity with two males when he described this species, we concur with Döbler’s (1973) syntypic rather than holotypic interpretation of the type specimens.] *Type depository*. Lectotype at DEI. *Type locality*. “Ceylon” (Sri Lanka).

*Euryoda paradoxa* (Horn): Horn, 1904:32.

*Prothyma paradoxa* (Horn): Fowler, 1912:303.

*Cylindera (Oligoma) paradoxa* (Horn): Rivalier, 1961:140.

*Cylindera (Oligoma) paradoxa* (Horn): Naviaux, 1984b:69, fig. 38–40.

*Cicindela (Oligoma) paradoxa* (Horn): Acciavatti, 1987:379, fig. 5.

**Diagnosis.**—Distinguished by the entirely glabrous body; two oval white spots; labrum with large white center.

**Description.**—*General habitus.* Body very small (7.5 mm); head and pronotum shiny dark bronze dorsally, bright green or violet reflections laterally; two oval, white elytral spots, one mesad at middle and one laterad on apical third; body almost totally glabrous dorsally and ventrally except for erect procoxal setae; ventral surface shiny black with slight greenish black reflections. *Head.* Labrum dark, slightly metallic laterally with a large white center; six submarginal setae; one medial labral tooth (more prominent on females than males) flanked by a rounded bulge on each side; clypeus, frons and vertex glabrous; rugae on frons transverse medially, arcuate dorsally; longitudinal rugae on vertex. *Prothorax.* Pronotum entirely glabrous. *Pterothorax.* Female mesepisternal coupling sulcus an elongate pit dorsally at middle. *Elytra.* Shiny, dark bronze almost black, surface densely punctured throughout, deepest basally, medially appearing uneven from a feeble longitudinal furrow; medial row of green foveae in furrow, a few additional green foveae on distal half beyond apical spot; one white spot mesad on middle third and another larger spot laterally at outer apical angle; elytral apex feebly microserrulate on most specimens, lacking microserrulations on others; elytral margin straight from outer apical angle to terminus then abruptly curving inward to suture; sutural spine absent. *Abdomen.* Completely glabrous, shiny. *Legs.* Trochanters slightly reddish, one subapical setae on each front segment, middle segments glabrous; femora metallic blue-green; tibiae reddish basally, metallic blue-green apically; tarsomeres metallic purple. *Male genitalia.* Aedeagus moderately enlarged on apical half and terminating with an acutely rounded point; small apical bead slightly bent to the left side in left lateral aspect.

**Distribution.**—(Fig. 52). Sri Lanka and southern Indian (Goa, Karnataka, Kerala, Tamil Nadu).

**Localities.**—SRI LANKA: Colombo District: Colombo Museum Garden, 10 m, 23.IV.1976 (CMNH). INDIA: Karnataka: 7 km E Sulya, 4.VI.1984, road cut (DLPC); 35 km E Mangalore, 29.V.1985 (DLPC); Jog Falls, 550 m, 10.VI.1987, forest path (DLPC); 50 km S Jog Falls, 650 m, 10.VI.1987, grassland (DLPC); 15 km E Karwar, 100 m, 12.VI.1987, scrub (DLPC); Goa: Salcete, VI.1925 (DLPC, CMNH).

**Ecology.**—Adults occur on the floor of open forest, brushy areas, fallow fields, and road cuts below 150 m elevation. Fowler (1912) reported that adults of this species were observed running swiftly over areas of sparse grasses rather than flying, although surprisingly he mentioned that they flew to lights at night. Naviaux (1984b) reported this species from forests and cut grass near the ocean.

### *Cicindela (Oligoma) lacunosa* Putzeys

*Cicindela lacunosa* Putzeys, 1875:68.

**Type status.** Lectotype, male [here designated]. **Type labels.** “Ceylan” [typeset]; “♂” [printed small square]; “16171” [typeset]; “Coll, J.v. Volxem, det. 9” [typeset within black rectangle]; “Cicindela lacunosa Pz.” [handscript yellow label]; “C. lacunosa Putz., det. J. Putzeys” [first line handscript, second typeset]; “TYPE” [typeset pink label]; “LECTOTYPE, Cicindela, lacunosa Putzeys, by R.E. Acciavatti, '85” [typed and handprinted red label]. [Lectotype is 7.5 mm; right elytron broken at point of its attachment to body, but still attached to pin.] Paralectotypes, one each sex at IRSNB, one female at DEI, each [here designated] labelled “PARALECTOTYPE” [typed and handprinted red label]. **Type depositary.** Lectotype and two paralectotypes at IRSNB; one female paralectotype at DEI. **Type locality.** “Ceylon” (Sri Lanka).

*Cylindera (Oligoma) lacunosa* (Putzeys): Rivalier, 1961:140.

*Cylindera (Oligoma) lacunosa* (Putzeys): Naviaux, 1984b:70, fig. 35–37.

**Diagnosis.**—Distinguished by the abundant, decumbent setae ventrally on body; uneven elytral surface; dull testaceous labrum.

*Description.*—*General habitus.* Body small (7.5–9 mm); dorsum entirely bronze; elytral surface uneven from polished raised areas; two oval maculae near lateral margin; body ventrally with abundant, decumbent setae laterally, shiny and glabrous medially. *Head.* Labrum mostly dull testaceous, darkened anteriorly at middle; one medial labral tooth (more prominent on females than males) flanked by a rounded bulge on each side; medial carina present; six submarginal setae; rugae on frons mostly concentric medially, arcuate dorsally merging with longitudinal rugae on vertex between eyes. *Prothorax.* Pronotum with wavy rugae which align longitudinally near center and appressed setae which originate from numerous green foveae in multiple rows laterally; proepisternum wrinkled, covered by appressed setae dense on ventral third scattered on dorsal two-thirds. *Pterothorax.* Female mesepisternal coupling sulcus a small circular pit dorsally at middle. *Elytra.* Elytral surface uneven from three irregular and polished raised areas; two white spots, anterior one smallest and situated at the middle, posterior one touches lateral margin at outer apical angle; apex microsculptate; apical margins gradually and uniformly rounded from outer apical angle; small acute sutural spine. *Abdomen.* Setae on sterna dense and decumbent laterally, glabrous medially. *Legs.* Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora metallic blue-green and copper; tibiae and tarsomeres metallic purple. *Male genitalia.* Aedeagus moderately enlarged on apical half tapering to an acute apex; small apical bead bent to the left; slightly raised lateral apical flange in both left and right lateral aspect.

*Distribution.*—(Fig. 52). Sri Lanka and southern India (Tamil Nadu).

*Localities.*—SRI LANKA: Wilpattu National Park, 24.XI.1980 (DLPC); Anuradhapura District: Anuradhapura, 25.XI.1980 (DLPC, CMNH); Kandy District: Kandy (DEI); Puttalam District: Puttalam (DEI); INDIA: Tamil Nadu: Madura(i) (DEI).

*Ecology.*—Adults are found in forest openings. Naviaux (1984b) reported this species a feeble flyer.

### Subgenus *Cicindela* (*Cylindera*) Westwood

*Cylindera* Westwood, 1831:300.

Type species.—*Cicindela germanica* Linnaeus, 1758.

*Cylindera* (*sensu stricto*) Westwood: Rivalier, 1950:232.

*Cicindela* (*Cylindera*) Westwood: Acciavatti, 1987:379, fig. 6.

*Diagnosis.*—*Cicindela* (*Cylindera*) species adults are distinguished from those of related subgenera by: 1) the male genitalic capsule containing a slender flagellum spiraled several times only on the left lateral aspect of the inner sac without raising any sustained membranes, and constantly associated with a small arciform sclerite basally; 2) small body size, narrow nearly elongate body form; 3) body glabrous dorsally and sparsely setose ventrally, proepisternum glabrous; 4) eyes not prominent; 5) elytral maculae mostly confined to the lateral margin, tendency for these to be reduced to small dots or lacking altogether; 6) adults of some species are brachypterous, although adults of most species do not actively fly even though their wings appear fully developed.

*Included species.*—Most species of *Cicindela* (*Cylindera*) inhabit the Palearctic biogeographic region; the following occur over the northern portions of the Indian subcontinent with some ranging into adjoining areas of the Palearctic biogeographic region: *C. (C.) descendens* Fischer, 1825; *C. (C.) armandi* Fairmaire, 1886; *C. (C.) dromicoides* Chaudoir, 1852; *C. (C.) delavayi* Fairmaire, 1886.

### Key to adults of *Cicindela* (*Cylindera*) species

1. Elytral apices smooth along edge, not microsculptate; elytral disc with large, well defined irregularly shaped impunctate areas; elytral maculae varied; two lateral maculae as irregular spots, narrow bands or small

- dots, none of which extend onto disc, on most specimens; elytra immaculate on some specimens ..... 2
- Elytral apices distinctly microsculptate although teeth may be small; elytral disc without impunctate areas; elytra marked with lunules which extend from the lateral margin onto the disc ..... *descendens* Fischer
  - 2.(1.) Labrum with one tooth at middle ..... *armandi* Fairmaire
    - Labrum with three equally long teeth ..... 3  - 3.(2.) Elytral sutural margin distinct, metallic contrasting with remainder of surface and two elongate maculae along lateral margin ..... *dromicoides* Chaudoir
    - Elytral sutural margin diffuse, metallic blending with remainder of surface; elytral maculae reduced to two small lateral dots on most specimens, absent on some specimens ..... *delavayi* Fairmaire

***Cicindela (Cylindera) descendens* Fischer**

*Cicindela descendens* Fischer, 1825:35, pl. 1, fig. 5.

*Type status.* Holotype [sex unspecified; unexamined; concept based on specimens! from Gilgit, India, at ZSI, and Paghman, Afghanistan, at IARI]. *Type depository.* ?SMTD. *Type locality.* "River of Baical" (Russian S.S.R., U.S.S.R.).

*Cylindera recta* Motschulsky, 1844:36.

*Type status.* Lectotype, male [here designated]. *Type labels.* "Soiow" [handscript letters all uncertain on small, narrow red label]; "Cylindera, recta, Motsch, Vongeria" [handscript, last word uncertain]; "nioctena, vicornis, Su Arias" [handscript, some letters uncertain, on reverse side of previous label]; "=Cic. kirilo-, vi Fisch., Dr. W. Horn det. 1926" [typeset except for handscript first two lines and last numeral of date]; "= Subsp. ripa-, ria Dj., Dr. W. Horn 1926" [same format as previous label]; "LECTOTYPE, Cylindera, recta Motschulsky, by R.E. Acciavatti, '86" [typed and handprinted red label]; "Cicindela (Cylindera) kirilovii Fischer det. R.E. Acciavatti, 1986" [typeset]. [Lectotype is 9.5 mm; missing all leg segments except right front femora and all antennomeres except scapes; most of the abdomen and a large dorsal part of the head and prothorax destroyed by dermestid feeding.] *Type depository.* Lectotype at ZMMU. *Type locality.* "Steppes des Kirguises" (eastern Kazakhstan, S.S.R., U.S.S.R.).

*Cicindela juliae* Ballion, 1871:322.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* Unknown. *Type locality.* Unreported.

*Cicindela obliquefasciata descendens* Fischer: Tschitscherine, 1903:3.

*Cicindela germanica descendens* Fischer: Horn, 1938: pl. 67.

*Cylindera (sensu stricto) kirilowi* (Fischer): Rivalier, 1950:232.

*Cicindela kirilowi (sic) descendens* Fischer: Mandl, 1955:322.

**Nomenclatural note.**—*Cicindela descendens* Fischer, 1825:35, is senior to *Cicindela kirilovii* Fischer, 1844:7, in designating this species, if these two names refer to the same species. Our studies indicate this species has a varied body form and structure throughout its geographic distribution. A detailed study of this variation is beyond the scope of this review and assigning names to various populations must await examination of syntypes.

**Diagnosis.**—Distinguished by the distinctly microsculptate elytral apices; elytral lunules extending onto disc.

**Description.**—*General habitus.* Body small to medium (9–11 mm); head and pronotum metallic copper-green; elytra dull black-green with spots representing each end of the humeral lunule, a separate widened middle band and a broad apical lunule; body copper-green ventrally. *Head.* Labrum short with one medial tooth; six to eight submarginal setae; frons and vertex with numerous rugae forming parallel ridges which become arcuate medially; genae glabrous. *Prothorax.* Pronotum subquadrate,



posterior angles prominent; surface finely and irregularly rugose on disc; numerous appressed setae laterally; proepisternum glabrous except for sparse setae anteroventrally, moderately raised wrinkles dorsally; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a moderately deep and elongate depression medially. *Elytra*. Elytral surface distinctly and densely granulate-punctate throughout; blue-green punctures contrasting with surface color laterally and on disc; humeral elytral lunule on most specimens divided into humeral and discal spots; middle band separate, widened and distinctly bent transverse portion extending from the lateral margin onto the disc; apical lunule broad; elytral apices distinctly microsculptate, although teeth may be small; small acute sutural spine. *Abdomen*. Setae on sterna sparse, appressed laterally, glabrous medially. *Legs*. Trochanters reddish, one subapical seta on each front and middle segment; femora dark metallic except for reddish testaceous distal end; tibiae reddish except for a dark distal end; tarsomeres reddish. *Male genitalia*. Not examined.

*Geographic variation*. — Specimens! from China have the elytral surface sparsely granulate-punctate with punctures deepest basally becoming nearly impunctate on the disc; laterally with wide, blue-green punctures which often touch one another and coalesce; middle band lacks a bend on its transverse portion. Specimens! from Afghanistan have an elytral surface densely granulate-punctate throughout; laterally blue-green punctures contrast with surface color and do not touch one another; middle band bent on its transverse portion.

*Distribution*. — (Fig. 52). Southcentral and eastern Palearctic biogeographic region, entering the Indian subcontinent only in extreme northern Pakistan (North-west Frontier) and northwest India (Jammu and Kashmir).

*Localities*. — This species was reported by Mandl and Piffel (1961) from an open plain at Satil, Jammu and Kashmir, India. AFGHANISTAN: Paghman, 2245 m, on moist soil, 29.V.1939 (IARI). CHINA: Heilongjiang: Harbin, 10.VI.1936 (CMNH); Darien, VIII.1919 (CMNH).

*Ecology*. — Adults are known from open grassland and moist soils during May through August.

### *Cicindela (Cylindera) armandi* Fairmaire

*Cicindela armandi* Fairmaire, 1886:223.

*Type status*. Lectotype, female [here designated]. *Type labels*. "Naturalist, Paris" [typeset]; "Cicindela armandi, Fm [letters uncertain] Yunnan" [handscript]; "TYPE" [typeset orange label]; "TYPE" [typeset pink label]; "R. Mus. Hist. Nat., Belg. I.G. 11.230" [typeset]; "cfr. Le Naturaliste, VIII, 1886, p. 223 [handscript]; "LECTOTYPE, Cicindela, armandi, Fairmaire, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 10 mm; missing middle right and rear left legs.] Paralectotypes, three females! at IRSNB, two females! and one male! at DEI, each [here designated] labelled "PARA-LECTOTYPE" [typed and handprinted red label]. *Type depository*. Lectotype and three paralectotypes at IRSNB; three paralectotypes at DEI. *Type locality*. "Yunnan" (China).

*Cylindera (sensu stricto) armandi* (Fairmaire): Rivalier, 1961:140.

*Diagnosis*. — Distinguished by the smooth edged elytral apices; one labral tooth.

*Description*. — *General habitus*. Body medium (10 mm); shiny dark brown or green-bronze head and pronotum; elytra metallic copper-brown laterally and along suture, medially with a large, black velvety impunctate area; elytral macula as a long, narrow lateral white line on apical half; ventrally body dark copper-brown. *Head*. Vertex flattened between small eyes; surface densely rugose. *Prothorax*. Pronotum with sparse appressed setae laterally; proepisternum and prosternum almost entirely glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a shallow, circular medial pit; brachypterous. *Elytra*. Disc medially with a large, black velvety impunctate area which is sinuate laterally; long, narrow lateral white macula from middle posteriorly nearly to apex; apex without microsculptations; apical margins straight from outer apical angle to extreme end, truncated before suture; no sutural spine. *Abdomen*. Sterna smooth and shiny, glabrous. *Legs*. Trochanters nonmetallic dark reddish, one subapical seta on each front and middle segment; femora metallic copper-black or greenish black; tibiae and tarsomeres metallic reddish basally, metallic green apically. *Male genitalia*. Not examined.

*Distribution*.—(Fig. 52). The presence of this species in Bhutan was reported by Mandl (1975). It occurs in China (Yunnan).

*Localities*.—CHINA: Yunnan: Yulongxueshan, 2750 m, Likiang, 7.VI.1988 (CMNH).

*Ecology*.—Habitat unreported but this flightless species probably has habitat requirements similar to *Cicindela dromicoides* Chaudoir.

### *Cicindela (Cylindera) dromicoides* Chaudoir

*Cicindela dromicoides* Chaudoir, 1852:21.

*Type status*. Syntypes [described from six specimens; unexamined; concept based on specimens collected in Kathmandu Valley, Nepal, at Godavari, and deposited at CMNH]. *Type depository*. ?MNHN. *Type locality*. "Nord de l'Hindostan and Nepal."

*Parmecus pictus* Motschulsky, 1864:173.

*Type status*. Lectotype, male [here designated]. *Type labels*. "Ind. or." [handscript yellow label]; "Parmecus, pictus, m., Ind. or." [handscript yellow label]; [a label without writing, red on one side]; "LECTOTYPE, Parmecus, pictus Motschulsky, by R.E. Acciavatti, '86" [typed and handprinted red label]; "Cicindela (Cylindera), dromicoides Chaudoir, det. R.E. Acciavatti, 1986" [typed and printed]. [All that remains of the lectotype is a portion of the pterothorax including part of the right elytron; however, from these body parts, the flattened mesepisternum indicates that the specimen is a male and the two, dark impunctate areas on the elytral disc and one elongate spot laterally at the middle of the elytron indicate that it is identical with *dromicoides* Chaudoir.] *Type depository*. Lectotype at ZMMU. *Type locality*. "Indes Orientales" (undoubtedly from northern India).

*Cicindela dromicoides* Chaudoir: Fowler, 1912:340, fig. 151.

*Cylindera (sensu stricto) dromicoides* (Chaudoir): Rivalier, 1961:140.

*Cylindera (sensu stricto) dromicoides* (Chaudoir): Naviaux, 1985:67, fig. 27, 52, 84.

*Diagnosis*.—Distinguished by the smooth edge on the elytral apices; elytral disc with large, irregular impunctate areas; two irregular or elongate lateral spots.

*Description*.—*General habitus*. Body medium (11–12 mm); head and pronotum varied from bright copper through dull dark brown (some specimens green or bronze to blue with purple reflections); elytra dark velvety brown with a bright bronze suture and two large, impunctate areas near suture, and two elongate lateral spots; body dark brown-black ventrally. *Head*. Flattened with numerous rugae between small eyes; female antennal scape on some specimens with one or two setae medially. *Pterothorax*. Pronotum bulging laterally, constricted anteriorly and posteriorly; lateral setae varied from sparse on some specimens to abundant on others; parallel rugae laterad on pronotal disc, irregular rugae at medial line; proepisternum black, smooth and polished, entirely glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a small pit at the center of a broad, shallow medial groove; wings shortened beyond first fold. *Elytra*. Medially with two large impunctate areas narrowly joined near suture; two elongate marginal spots laterally, one at the middle and the other subapically; apex without microsculptulations; apical margins straight from outer apical angle to extreme end then truncated before suture which lacks a spine. *Abdomen*. Sterna smooth and shiny, glabrous. *Legs*. Trochanters non-metallic dark reddish, one subapical seta on each front and middle segment; femora metallic copper-black or greenish black; tibiae and tarsomeres reddish metallic basally, metallic green apically. *Male genitalia*. Aedeagus slender, nearly of uniform width on middle third, tapering gradually to a long, acute apex slightly bent to the right side and supported by two long slightly raised flanges on the right side in left lateral aspect forming a long concavity.

*Geographic variation*.—Specimens throughout the range of this species have varied body size and coloration. Larger specimens occur at some higher mountain passes of Nepal (Acciavatti, 1987). In other high elevation populations, some specimens exhibit a green, blue or purple head and pronotum rather than the bright copper on most specimens found at lower elevations.

*Distribution*.—(Fig. 53). Northern India (Himachal Pradesh, Uttar Pradesh, West Bengal, Sikkim, Arunachal Pradesh, Meghalaya) and Nepal. Records from

Heynes-Wood and Dover (1928) and specimens! labelled from Maharashtra, Bihar and Tamil Nadu, India, are of questionable origin.

*Localities.*—NEPAL: Kathmandu Valley: Nagarjung and Jamacok Mountains, 1400 to 1600 m, 18.VIII.1983, second growth forest (SMFM, CMNH); Kathmandu Valley, Sunderijal, 2460 m, 12.VI.1967, oak forest (CNCO); Kathmandu Valley, Sunderijal, 1846 m, 2.VII.1967, pastures (CNCO); Kathmandu Valley, Godavari, 2810 m, 31.V.1986, forest path (DLPC); Kathmandu Valley, Kakni, 2155 m, V–VI.1972 (CMNH); Lamjura Pass, 3690 m, IX.1971 (CMNH); Dhading District: Buri Gandaki opposite Pangshing to bridge below Nyak, 1600 to 1800 m, 1.VIII.1983, mixed woodland (SMFM, CMNH); Gorka District: Buri Gandaki, Nyak to lower Chuling Khola Valley, 2450 to 2870 m, 2.VIII.1983, pastures and *Pinus excelsa* forest (SMFM, CMNH); Terhatum District: Tinjura Dara, 2450 to 2720 m, 17.IX.1983, maturing mixed deciduous forest (CMNH); Mustang District: Thakkola, pass between Titi and Taglung, 2700 to 2800 m, 3.VII.1970 (SMFM, CMNH); Ramechap District: Chordung/Jiri, 2900 to 3100 m, 30.VIII–3.IX.1970 (SMFM). INDIA: Himachal Pradesh: 10 km N Solon, 19.VII.1982, forest path (DLPC); 10 km S Narkunda, 22.VII.1982, forest path (DLPC).

*Ecology.*—This flightless species is found on the floor of oak woodlands to fir forests where its adults run swiftly through the leaf litter and grass. They frequently are encountered along clay trails at elevations between 1200 to 3000 m (Acciavatti, 1987). They appear commonly around steep road cuts and hillsides above 2000 m. Adult emergence begins during early premonsoon rains (Naviaux, 1985).

### *Cicindela (Cylindera) delavayi* Fairmaire

*Cicindela funebris* Schmidt-Goebel, 1846:8 (preoccupied, Sturm, 1827:105).

*Type status.* Syntypes, female and male [examined by J. Probst (personal communication, 1988) at our request and compared with specimen! sent him and returned to CMNH for reference]. *Type labels.* Syntypic female labelled "Typus! teste, Dr. Obenberger" [printed red label]; "Birma, Helfer" [handwritten]; "Mus. Pragense, Tenasserim, Coll-Helfer" [printed]; "Cicindela funebris Schm., G. Unicum Inobis Typus" [printed]; "Typus! Teste me!! Intact, Det. Dr. Obenberger" ['Typus' underlined, handwritten and printed]; "Mus. Nat. Pragae, 26 3 766" [printed]. The syntypic male has similar label data but lacks the fifth label. [Both syntypes have green heads.] *Type depository.* Syntypes at NMP. *Type locality.* "Birma" (Tenasserim, Burma).

*Cicindela delavayi* Fairmaire, 1886:223.

*Type status.* Lectotype, female [here designated]. *Type labels.* "coll. Fleutiaux, typique" [typeset and manuscript]; "Yunnan" [handscript]; "Type! coll. W Horn" [typeset within thin black border]; "Syn-typus" [typeset red label]; "EBERSWALDE, DEI" [typeset]; "LECTOTYPE, Cicindela, delavayi Fleutiaux, by R.E. Acciavatti, '84" [typed and handprinted red label]. [Lectotype is 7 mm; apical third of left elytron broken off; body blue dorsally.] *Type depository.* Lectotype at DEI. *Type locality.* "Yunnan" (China).

*Cicindela dolens* Fleutiaux, 1886b:111.

*Type status.* Syntype(s)? [unexamined; synonymy of this species based on Horn (1926)]. *Type depository.* ?MHNHP. *Type locality.* "Indes Orientales, Bombay."

*Cicindela doleres (sic)* Fleutiaux: Heynes-Wood and Dover, 1928:78.

*Cylindera (sensu stricto) delavayi* (Fairmaire): Rivalier, 1961:140.

*Diagnosis.*—Distinguished by the smooth elytral apices; elytral disc with large impunctate areas; two small dots at elytral margin (some specimens immaculate).

*Description.*—*General habitus.* Body very small to small (7–10 mm); head and pronotum copper or green, slightly shiny; pronotum laterally with one row of sparse, appressed setae; elytra dull, color varied from dark bronze to blue, some specimens green; two inconspicuous velvety impunctate areas on elytral disc; two small yellow dots laterally on elytra; body shiny black ventrally. *Head.* Labrum nonmetallic with three small medial teeth and six to eight submarginal setae; frons and vertex finely sculptured with numerous slightly raised ridges all parallel between the eyes which are not prominent. *Prothorax.* Propisternum with sparse setae ventrally, glabrous dorsally. *Pterothorax.* Female mesepisternal coupling sulcus a shallow, curved depression along posterior margin at middle. *Elytra.* Dull,

dark bronze or blue (green on some specimens); medially with two distinctive velvety, impunctate areas (on a few specimens narrowly joined along suture); two small yellow dots (inconspicuous on some specimens) laterally, one at middle, the other subapically; apex not microserrulate; apical margins cojointly rounded; sutural spine tiny. *Abdomen*. Sterna glabrous medially, sparsely setose laterally. *Legs*. Trochanters nonmetallic dark, one subapical seta on each front and middle segment; tibiae and tarsomeres black with metallic copper, purple and green reflections. *Male genitalia*. Aedeagus slender and uniformly wide along most of its length; acutely rounded apex slightly displaced toward the right side in left lateral aspect; apex lacking any supporting flange.

*Distribution*.—(Fig. 53). India (West Bengal, Sikkim, Meghalaya, Nagaland, Manipur, Assam), Bhutan and Nepal. Ranges eastward into Burma and southern China. Records from Heynes-Wood and Dover (1928) for Punjab, and Maharashtra, India, are most likely incorrect.

*Localities*.—INDIA: Meghalaya: Shillong, 1540 m, V.1918 (DLPC); Shillong, VI.1924 (DLPC); Mawphlang, 1720 m, 7.V.1985, forest path (DLPC). NEPAL: Dhankuta, Arun Valley, Num, 1500 m, 3–6.VI.1983 (JPC, CMNH). BHUTAN (JPC). THAILAND: Chaing Mai, Doi Pui, 25.VI.1985 (CMNH). CHINA: Szechuan: Guifu-shan (CMNH); Yunnan: Vallis flumin., Soling-ho (CMNH); Nord Est Yunnan, Kut-Sin-Fou, 2000 m (CMNH).

*Ecology*.—Adults of this flightless species occur on the floor of moist forests.

*Remarks*.—Mandl (1975) concluded from the study of a large series of specimens from the same locality that *Cicindela delavayi* is a monotypic species because all the previously named color variants occur together in certain populations.

### Subgenus *Cicindela* (*Ifasina*) Jeannel

*Cicindela* (*Ifasina*) Jeannel, 1946:153.

Type species.—*Cicindela fallax* Coquerel, 1851.

*Cylindera* (*Ifasina*) Jeannel: Rivalier, 1950:233.

*Cylindera* (*Ifasina*) Jeannel: Rivalier, 1958:322.

*Cylindera* (*Ifasina*) Jeannel: Rivalier, 1961:141.

*Nomenclatural note*.—Horn (1926) considered *Cicindela fallax* Coquerel, 1851, a junior synonym of *Cicindela disjuncta* Dejean, 1825.

*Diagnosis*.—*Cicindela* (*Ifasina*) species adults can be distinguished from members of other subgenera by: 1) male genitalic inner sac possessing a flagellum coiled to form two to several convolutions only on the left lateral aspect without raising any sustained membranes, and which closely associates with a small, arcuate or angled sclerite, termed “small stiffening rib” (Freitag et al., 1985), at its slightly enlarged proximal end; 2) small and slender body with moderate to fine surface sculpturing; 3) moderate amounts of appressed setae restricted to certain sclerites and greatly reduced or absent from others; 4) varied pattern of elytral maculae; on adults of most species lunules separated into spots, on adults of some species certain spots reduced to small dots, on adults of other species certain spots missing, and on adults of a few species all spots are missing; 5) elytral surface exhibiting one or two additional types of sculpturing, such as raised polished areas, dull impunctate areas, brilliant metallic iridescent areas, glossy black areas; 6) labral surface color and texture varied; on adults of many species metallic, on adults of others nonmetallic and darkened, on adults of certain species whitish or testaceous either partially or entirely; 7) the six to ten submarginal labral setae and small medial labral teeth.

*Included species*.—*Cicindela* (*Ifasina*) species are well represented in the Ethiopian and Oriental biogeographic regions and attain greatest diversity in the Oriental region with well over three dozen species, the following of which occur

on the Indian subcontinent: *C. (I.) foveolata* Schaum, 1863; *C. (I.) cyclobregma*, new species; *C. (I.) viduata* Fabricius, 1801, new rank; *C. (I.) viridilabris* Chaudoir, 1852; *C. (I.) labioaenea* Horn, 1892, new rank; *C. (I.) fallaciosa* Horn, 1897, new rank; *C. (I.) severini* Horn, 1893, new rank; *C. (I.) collicia*, new species; *C. (I.) nietneri* Horn, 1894; *C. (I.) belli* Horn, 1894; *C. (I.) umbropolita* Horn, 1905; *C. (I.) ganglbaueri* Horn, 1892; *C. (I.) dormeri* Horn, 1898; *C. (I.) henryi* Horn, 1925; *C. (I.) waterhousei* Horn, 1900; *C. (I.) willeyi* Horn, 1904; *C. (I.) seriepunctata* Horn, 1892; *C. (I.) melitops*, new species; *C. (I.) spinolai* Gestro, 1889; *C. (I.) paucipilina*, new species; *C. (I.) limitisca*, new species; *C. (I.) subtilesignata* Mandl, 1970, new rank; *C. (I.) decempunctata* Dejean, 1825; *C. (I.) anelia*, new species; *C. (I.) sikhimensis* Mandl, 1982, new rank; *C. (I.) kaleea* Bates, 1866.

One Indonesian species, *Cicindela (Ifasina) holosericea* Fabricius, 1801, is briefly compared with an Indian subcontinent species with which it has been previously confused. One Burmese species, *C. (I.) modica* Gestro, 1893, new rank, is briefly compared with one Indian subcontinent species to which it had been subspecifically assigned.

#### Key to adults of *Cicindela (Ifasina)* species

1. Labrum entirely dark medially and over entire surface on most specimens, but a whitish or testaceous area may be present on each side of a darkened middle on a few specimens; darkened labrum nonmetallic shiny brown to black on some specimens, metallic copper-green on others, purplish black on others ..... 2
  - Labrum either entirely whitish or pale brown medially with or without dark margins, no metallic reflections ..... 19
- 2.(1) Humeral elytral angle on most specimens with a macula; if humeral macula small or inconspicuous on a specimen, remainder of elytra with three spots arranged in a medial row ..... 3
  - Humeral elytral angle on most specimens unmarked; if minute humeral macula present on a specimen, remainder of elytra either immaculate or spots not arranged in a medial row ..... 10
- 3.(2) Middle elytral band long and thin on most specimens, represented by two spots on other specimens, and two spots joined by a thin line on others ..... 4
  - Middle elytral band represented by one oval or oblong medial spot ..... 8
- 4.(3) Most of apical elytral margin with a lunule which is separated on some specimens and attached to anterior apical spot on others ... 5
  - Most of apical elytral margin lacking a lunule, only anterior apical spot present, a short marginal extension present on some specimens but this reaches no more than half way to suture ..... 6
- 5.(4) Labrum of most specimens testaceous on each side of a dark, brownish black middle and all margins darkened, labrum on a few specimens entirely darkened; elytral spots large; humeral and apical lunules complete on some specimens; apical marginal extension broad and reaching suture; pronotum laterally with several irregular rows of appressed setae; female elytra with epipleural groove slightly twisted to give a slight lateral expansion at middle ... *decempunctata* Dejean
  - Labrum entirely brownish black on most specimens, two pale testaceous areas on a few specimens; elytral spots small and often

- surrounded by a darkened infuscation; humeral lunule divided into two spots; apical lunule complete on a few specimens; marginal extension of apical macula narrow and on most specimens not reaching suture; pronotum laterally glabrous or with one irregular row of appressed setae; female elytra with epipleural groove twisted at right angles to create a wide lateral expansion at middle . . . . .
- 6.(4.) Labrum testaceous on each side of a dark, brownish black middle, all margins darkened; lateral elytral margin with a wide copper-green band mesad of a broad and purple band extending from outer humeral angle to suture, encompassing much of apical spot . . . . . *anelia*, new species
- Labrum entirely darkened, nonmetallic shiny brown or black; lateral elytral margin with only a diffuse copper-green humeral area; purple margin diffuse, narrowly reaching suture, not encompassing apical spot . . . . . *limitisca*, new species 7
- 7.(6.) Entire lateral pronotal margin with many appressed setae originating from two to several nearly regular rows of large, closely spaced setigerous punctures; middle elytral band complete, only slightly oblique and narrowed at middle; small, moderately deep punctures on elytral disc, especially around terminus of middle band . . . . .
- Entire lateral pronotal margin with sparse appressed setae originating from one to two irregular rows of small, widely spaced setigerous punctures; middle elytral band on most specimens represented by two irregularly shaped spots, medial one situated posteriorly, on some specimens joined by a thin oblique line; elytral disc with minute, shallow punctures, area around terminus of middle band nearly impunctate . . . . . *subtilesignata* Mandl, new rank
- 8.(3.) Pronotum laterally with sparse, setigerous punctures . . . . . *henryi* Horn
- Pronotum laterally glabrous . . . . . 9
- 9.(8.) Abdomen laterally with dense, fine appressed setae on anterior three sterna; female pronotum conical, widest posteriorly; male mandibles not curved posteroventrally and penultimate tooth of left mandible not projecting forward . . . . . *ganglbaueri* Horn
- Abdomen laterally glabrous on some specimens, a few setae on first sternum of others; female pronotum anteriorly and posteriorly coequally wide; male mandibles abruptly curved posteroventrally with penultimate tooth of left mandible projecting forward . . . *dormeri* Horn
- 10.(2.) Lateral elytra margins glossy black to purple-black with color bulging medially toward disc . . . . . *umbropolita* Horn
- Lateral elytra margins shiny iridescent purple, blue or copper, either abruptly or gradually contrasting with disc color . . . . . 11
- 11.(10.) Elytra either with small, narrow moderately impressed iridescent punctures, or surface nearly impunctate, especially on apical third 12
- Elytra with wide, shallowly impressed iridescent punctures many of which coalesce, especially on apical third . . . *viduata* Fabricius, new rank
- 12.(11.) Anterior reflexed margin of pronotum medially with curved rugae merging with those on the disc such that medial line extends onto anterior reflexed margin; elytra laterally shiny black lacking a con-

- trasting metallic margin or humeral area; elytral surface dull, with numerous, impunctate areas, slightly shiny and mostly on apical third; female mesepisterna broadly concave, some females without an obvious depression, others with a small, shallow circular depression at or below middle ..... *cyclobregma*, new species
- Anterior reflexed margin of pronotum medially with transverse rugae not merging with those on the disc, medial line of pronotal disc not extending onto anterior reflexed margin; elytra laterally metallic, margin and humeral area diffuse iridescent on some specimens, abruptly contrasting in color with remainder of surface on other specimens; elytral surface with only punctate areas on apical third; female mesepisterna with a pit, cavity or groove ..... 13
- 13.(12.) Elytra with a distinctive iridescent blue-green humeral crescent whose apical end terminates abruptly and contrasts with dull, nonmetallic, dark elytral color laterally and on disc; lateral elytral margin narrowly or not at all metallic ..... 14
- Elytra of some specimens with an inconspicuous diffuse iridescent humeral area lacking an apical end and gradually merging with shiny, metallic lateral margin and disc; elytra of other specimens without any such iridescent humeral area; lateral elytral margin broadly and diffusely metallic ..... 16
- 14.(13.) Numerous, appressed lateral pronotal setae originating from small, submarginal punctures in multiple rows; frons coarsely, transversely rugose medially; labral carina large, broad . . *fallaciosa* Horn, new rank
- Sparse, appressed lateral pronotal setae originating from small submarginal punctures or glabrous; frons finely, transversely rugose medially; labral carina on some specimens thin, narrowly raised, other specimens without any carina ..... 15
- 15.(14.) Pronotum laterally sparsely setose, appressed submarginal setae originating from a few to many small, irregularly arranged punctures; elytra dark, copper-brown, numerous contrasting small, shallow, blue-green punctures on apical third; labrum metallic copper, medial carina thin, narrowly raised and darkened by extension of marginal pigmentation along midline ..... *collicia*, new species
- Pronotum laterally glabrous, a few inconspicuous hairs on a few specimens; elytra black, nearly impunctate on apical third, no more than noncontrasting minute punctures, on a few specimens small iridescent flecks; labrum metallic copper, lacking a medial carina and darkened extension of marginal pigment along midline ..... *severini* Horn, new rank
- 16.(13.) Four elytral spots, most large and elongate with middle two on some specimens narrowly joined; disc uniformly punctate; pronotum laterally with numerous large setigerous punctures often occurring in multiple rows; proepisterna shiny blue, purple, copper-green or bronze with large setigerous punctures throughout elytra on most specimens ..... 17
- Elytra of most specimens with three or fewer small and oval spots (minute fourth dot on only a few specimens); disc medially with a dull, longitudinal area surrounding a small discal spot and with distinctly fewer punctures than remainder of surface; pronotum lat-



- erally varied, glabrous or with sparse appressed setae originating from a few to many irregularly arranged punctures; proepisterna shiny black, some specimens with green or purple reflections, small dense setigerous punctures absent dorsally ..... *belli* Horn
- 17.(16.) Body dull, dark purple-black dorsally; elytra with four nearly circular spots alternating between medial and lateral positions from anterior to posterior; elytral surface with small, noncontrasting punctures shallow basally becoming nearly impunctate apically ... *nietneri* Horn
- Body shiny, copper, copper-green or green dorsally; elytra with whitish yellow spots, only anterior spot consistently circular, others irregular in shape; elytral surface with large, contrasting blue-green punctures deepest basally becoming shallower apically ..... 18
- 18.(17.) Wide rugae on vertex of head, 8 to 11 nearly complete rugae between eye and midline; female mesepisternal coupling sulcus a medial groove or small pit along posterior margin ..... *viridilabris* Chaudoir
- Narrow rugae on vertex of head, 12 to 16 nearly complete rugae between eye and midline; female mesepisternal coupling sulcus a large, deep cavity medially along posterior margin ... *labioaenea* Horn
- 19.(1.) Genae on most specimens entirely setose, on some specimens sparsely setose only ventrally, on other specimens setae missing; if genae lack setae, long, narrow macula at lateral elytral margin and middle trochanters each lack a subapical seta ..... 20
- Genae entirely glabrous; elytra lack a long, narrow macula at margin; middle trochanters possess a subapical seta ..... 22
- 20.(19.) Labrum short, its medial longitudinal dimension not exceeding half its transverse dimension; small elytral spots or lunules; elytral surface smooth and evenly contoured ..... 21
- Labrum long, its medial longitudinal dimension exceeding half its transverse dimension; elytral surface immaculate, rough and unevenly countoured ..... *foveolata* Schaum
- 21.(20.) Humeral elytral lunule divided into basal and apical dots; female mesepisternal coupling sulcus a distinct groove ending in a shallow depression located mesoventrally ..... *kaleea* Bates
- Humeral elytral lunule absent; female mesepisternal coupling sulcus a shallow groove ..... *sikhimensis* Mandl, new rank
- 22.(19.) Distinctive pronotal bulge medially on disc in front of posterior transverse sulcus; female pronotum conical, widest at posterior margin; male mandibles curved posteroventrally, penultimate tooth on each greatly enlarged and projecting forward ..... 23
- Not with this combination of characters ..... 24
- 23.(22.) Medial line of pronotal disc dividing dorsal bulge in two; pronotal disc with shallow transverse rugae ending before reaching posterior transverse sulcus and without any deep transverse rugae; female elytral apices rounded, not prolonged, not sinuate, nor ending in a long spine ..... *waterhousei* Horn
- Medial line of pronotal disc not dividing dorsal bulge; pronotal disc with shallow transverse rugae from anterior nearly to posterior transverse sulcus and with a deep transverse ruga evident posteriorly; female elytral apices much prolonged and strongly sinuate, ending in a long spine ..... *willeyi* Horn

- 24.(22.) Humeral elytral spot present ..... *paucipilina*, new species  
 – Humeral elytral spot absent ..... 25  
 25.(24.) Labrum testaceous on middle, metallic blue-green on each lateral  
 quarter; six to eight submarginal labral setae; eyes small, not prom-  
 inent; numerous moderately deep punctures on elytral disc con-  
 trasting with surface color ..... *seriepunctata* Horn  
 – Labrum entirely pale and tawny; eight to ten submarginal labral  
 setae; eyes large, prominent; elytral disc nearly impunctate, shallow  
 noncontrasting punctures only basally ..... *melitops*, new species

*Cicindela (Ifasina) foveolata* Schaum

*Cicindela foveolata* Schaum, 1863:59.

*Type status.* Syntype(s)? [unexamined; concept based on a comparison of specimens! from Indonesia, Sulawesi, Pangie, at DEI with the original description]. *Type depository.* ?MNHB. *Type locality.* "Celebes" (Sulawesi, Indonesia).

*Cylindera (Ifasina) foveolata* (Schaum): Rivalier, 1961:142.

*Cylindera (Ifasina) foveolata* (Schaum): Naviaux, 1985:73, fig. 23, 58, 90.

*Diagnosis.* — Distinguished by the setose genae; shiny blackish bronze, unevenly sculptured and immaculate elytra; subsutural row of small blue-green or copper foveae on elytra.

*Description.* — *General habitus.* Body small (8 mm); shiny black head and pronotum, the former blue-green laterally, the latter slightly copper and blue-green laterally; elytra immaculate, surface uneven, shiny blackish bronze (some specimens with blue reflections); subsutural row of small blue-green or copper foveae; body copper and blue-green ventrally. *Head.* Penultimate segment of labial palpi translucent and dilated; last segment metallic and narrow; labrum long, one small medial tooth, nonmetallic testaceous surface except for dark anterior margin; six to eight submarginal labral setae, some of which originate behind others; frons glabrous with fine, transverse rugae; vertex of head with 8 to 11 coarsely raised rugae between each eye and midline with four to five nearest each eye straight and longitudinal, remaining rugae wavy and irregular; rugae arcuate around a medial area where some rugae form a circular pattern; genae with moderately dense, appressed setae. *Prothorax.* Pronotal surface with coarse rugae forming a wavy irregular pattern on anterior reflexed margin; rugae on middle of disc slightly transverse, medial line on disc evident; pronotum laterally with numerous appressed setae originating from large punctures in multiple rows near edge; proepisterna coppery, glabrous, wrinkled on dorsal third with sparse appressed setae originating from large, setigerous punctures on ventral two-thirds; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a shallow medial pit; all pleura except mesepisterna covered with moderately dense appressed setae. *Elytra.* Immaculate, shiny blackish bronze (a few specimens with blue reflections most noticeable at humeral angle); surface uneven, forming an irregular pattern; punctures small, blue-green and discrete throughout but deepest on basal half; subsutural row of blue-green or copper foveae; apices microserrulate, margins separately rounded; minute sutural spine. *Abdomen.* Sterna covered with moderately dense appressed setae laterally and fine hairs medially. *Legs.* Trochanters brown testaceous, one subapical seta on each front and middle segment; femora metallic copper-green; tibiae and tarsomeres purplish green. *Male genitalia.* Aedeagus enlarged, widest at middle and tapering gradually to a rounded and bent beak at apex (Naviaux, 1985).

*Distribution.* — (Fig. 52). India (Madhya Pradesh, Uttar Pradesh, Karnataka, Kerala, Tamil Nadu, West Bengal, Bihar, Meghalaya), Bangladesh (Dinajpur District, Dacca, Chittagong) and Nepal. Occurs also in Burma, Vietnam, Indonesia (Sulawesi) and the Philippines (Luzon).

*Localities.* — INDIA: Uttar Pradesh: 15 km N Dehra Dun, 30.VI.1983, forest path (DLPC); Madhya Pradesh: Kanha National Park, 16.VI.1982, forest path (DLPC); Bihar: 65 km W Ranchi, 23.VI.1986, scrub forest (DLPC); West Bengal: 15 km N Siliguri, 3.VI.1985, forest path (DLPC); Karnataka: 5 km N Mudigere, 5.VI.1984, forest path (DLPC); 20 km W Shimoga, 11.VI.1985, scrub forest floor (DLPC); 50 km W Dharwar, 14.VI.1987, scrub forest (DLPC); Kerala: Karkur Ghat (DEI); Tamil

Nadu: Nilgiri Hills, Gudalar, 1075 m, IV.1949 (CMNH). BANGLADESH: Dinajpur District: Dhanjuri, 1963 (CMNH). NEPAL: Chitwan National Park, 15 km S Sauraha, 28.V.1986, forest path (DLPC, CMNH); Koshi, Dharan, 18.VI.1985 (CMNH). BURMA: Tienzo (DEI). VIETNAM: Chiem-Hoa (DEI). INDONESIA: Sulawesi: Pangie (DEI). PHILIPPINES: Luzon (DEI).

*Ecology.*—Adults are found in open areas on the floor of primary forest, road cuts, and move to open scrub forest during the monsoon. Naviaux (1985) reported this species along forest trails in Nepal.

*Cicindela (Ifasina) cyclobregma*, new species

*Diagnosis.*—Distinguished by the medial line on pronotal disc extending onto the anterior reflexed margin of the pronotum; rugae at middle of vertex coarse forming a concentric pattern on a small distinctive bulge; labrum metallic blackish bronze.

*Description.*—*General habitus.* (Fig. 28). Body very small (7–8 mm); body form slightly robust; dorsum dark; head and pronotum black only slightly shiny; elytral form wider on apical third; elytral surface dull with numerous impunctate areas slightly shiny and mostly on apical third, laterally with shiny black margin; one medial dot just anterior to widest point of elytra; body covered by sparse appressed setae ventrally. *Head.* Labrum short, metallic blackish bronze; six to eight submarginal setae; medial carina conspicuous; proximal four antennomeres bronze; one subapical seta on antennal scape; clypeus, frons, vertex and genae glabrous; frons with moderately fine rugae which form a slightly transverse and wavy pattern; 12 to 14 slightly raised, parallel and wavy rugae between eye and vertex midline; coarser rugae forming a concentric pattern on a small bulge at middle; eyes not prominent. *Prothorax.* Pronotal surface with moderately fine rugae which form a pattern of moderately raised ridges in alternating directions, many short, parallel ridges converging along medial line and on posterior portions of disc, short grooves at extreme edge; anterior reflexed margin of pronotum medially with curved rugae merging with those on the anterior portion of disc such that medial line extends onto anterior reflexed margin; lateral margin of pronotum sparsely setose, forming several irregular rows and originating from small setigerous punctures which extend from lateral edge mesad; proepisterna mostly covered by sparse setae originating from small setigerous punctures except along entire dorsal margin which is glabrous with short, shallow grooves; prosternum glabrous. *Pterothorax.* Female mesepisterna broadly concave without a depression on some specimens but with a small, shallow circular depression at or below middle on other specimens. *Elytra.* Elytral form narrowest at base, widest across outer apical angle; elytral surface dull, with numerous, impunctate areas slightly shiny and mostly on apical third, laterally without a contrasting metallic margin or humeral area, at most shiny black; macula as one medial dot just anterior to widest point of elytra; apex microsculptate; apical elytral margins separately and gradually rounded from outer apical angle to suture; sutural spine small. *Abdomen.* Sterna black, covered by sparse lateral setae and fine hairs medially. *Legs.* Trochanters nonmetallic brown, one subapical seta on each front and middle segment; femora dark bronze and greenish bronze except for nonmetallic brown distal tip; tibiae and tarsomeres nonmetallic brown. *Male genitalia.* Aedeagus broad, widest at middle and gradually narrowing on apical third before abruptly tapering to a broad, truncated apex with a lightly sclerotized tip slightly displaced to the right in left lateral aspect.

*Body size.*—*Holotype.* Body length 7.3 mm, elytral width 2.6 mm. *Allotype.* Male—Body length 7.0 mm, elytral width 2.0 mm.

*Type locality.*—Nengba, 155 m, Assam, India.

*Type specimens.*—Holotype, female glued on paper, labelled “Assam, Nengba 500 ft, 20.V.60, Schmid leg.” [handscript in blue pen with dotted line underlining collector’s name and ‘leg.’ typeset]. Male allotype pinned with a minute needle, labelled “Ind. Mus., Kalimpong, Darjeeling dist., E. Himalayas, 600 to 4500 ft., 24.IV–10.V.15, F.H. Gravely.” [typeset with first line underlined and last printed sideways on a folded label]; “3070, H2” [typeset, first numeral underlined]. Female paratype glued on paper, labelled “Carin Cheba, 900 to 1100 m., L.Fea V XII-88” [typeset within a thin black border]; “triguttata, Herbst” [handscript]; “triguttata Hbt, det. W. Horn” [first line handscript, second typeset].

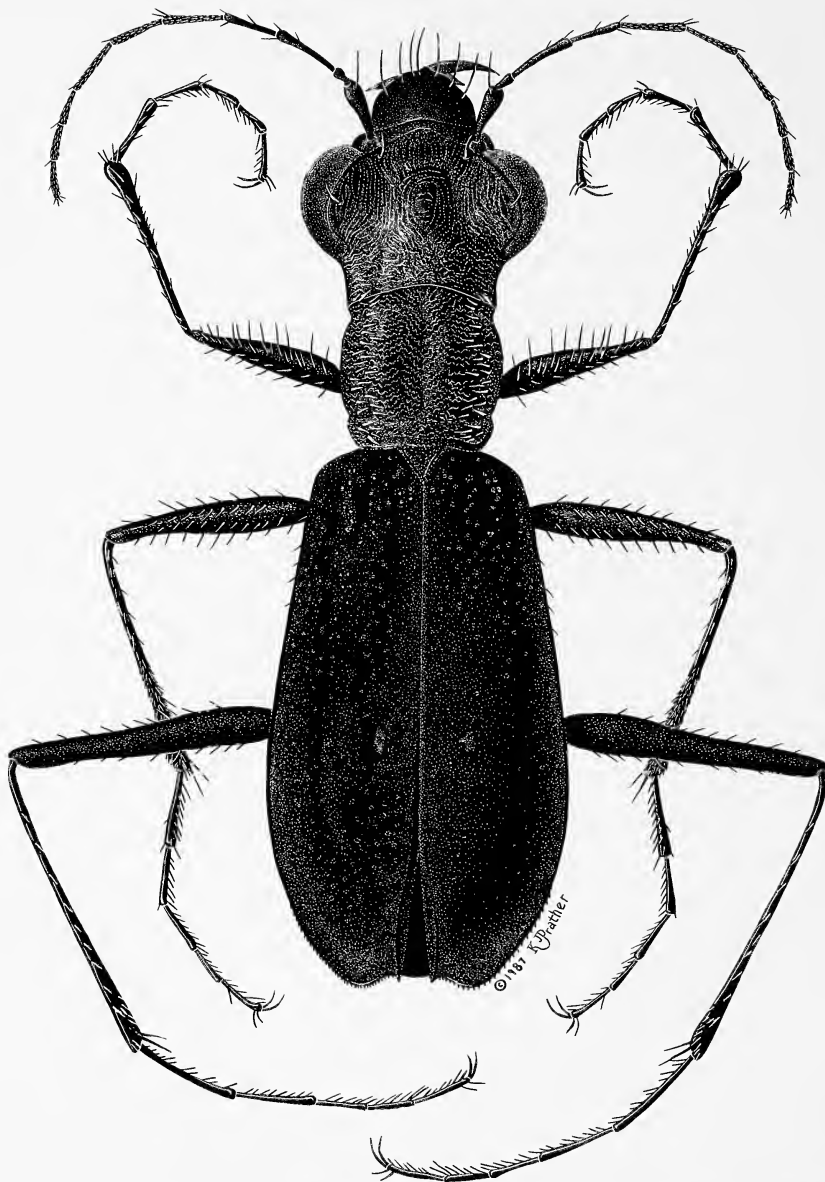


Fig. 28.—*Cicindela (Ifasina) cyclobregma*, new species, female holotype from Nengba, 500 ft (155 m), Assam, India. (Body size, 7.3 mm.)

*Type depository.*—Holotype at CMNH; allotype at ZSI; paratype at IRSNB.

*Distribution.*—(Fig. 53). India (Assam, West Bengal). Also from Burma and Laos.

*Localities.*—INDIA: Assam: Nengba, 155 m, 20.V.1960 (CMNH); West Bengal: Darjeeling District, Kalimpong, eastern Himalayas, 185 to 1385 m, 24.IV–10.V.1915 (ZSI). BURMA: Kayah State: Carin Cheba, 900 to 1100 m, L. Fea V–XII.1888 (IRSNB). LAOS: Vientiane Province, Ban Van Eue, 15.VI.1966 (BPBM).

*Ecology.*—The habitat details for this species are unreported but the most reliable data indicate adults occur at low to middle elevations during May and June.

*Etymology.*—This species name is feminine singular and derived by combining the Greek *cycl* (circle) and *bregma* (top of the head) with reference to the concentric pattern of moderately raised rugae on a small bulge medially on the vertex of the head.

*Remarks.*—*Cicindela (Ifasina) cyclobregma* is closely related to *Cicindela (Ifasina) holosericea* Fabricius, 1801:243, and their superficial resemblance undoubtedly confused previous authors. *Cicindela holosericea* does not occur on the Indian subcontinent but further east in the Oriental biogeographic region. Only adults of these two species share the distinctive curved rugae and medial line extending from the disc onto the anterior reflexed margin of the pronotum. *Cicindela cyclobregma* adults in comparison with those of *C. holosericea* differ in the following characters: 1) females have broadly concave mesepisterna without a depression on some specimens but with a small, shallow circular depression at or below middle on others, rather than female mesepisterna with a narrow medial groove; 2) pronotum sparsely setose, forming several irregular rows and originating from small setigerous punctures which extend from lateral edge mesad, rather than one partial row of a few sparse setae originating mesad and not touching lateral edge; 3) eyes not prominent rather than eyes distinctly bulging; 4) 12 to 14 slightly raised, parallel and wavy rugae between eye and a concentric pattern of rugae on a small bulge at middle, rather than 10 to 12 mostly complete ridges between each eye and vertex midline with all ridges longitudinal; 5) elytral surface dull with one small white medial dot, rather than elytra surface with shiny raised areas and three faint dots, two laterally and one medially.

### *Cicindela (Ifasina) viduata* Fabricius, new rank

*Cicindela viduata* Fabricius, 1801:242.

*Type status.* Lectotype, female [here designated]. *Type labels.* [A small green square]; "Sumatra, Daldorff. Mus: T, Lund. Trigguttatus Herbst: Cicindela viduata F." [handscript]; "Zool. Museum, DK Copenhagen" [typeset]; "LECTOTYPE, Cicindela, viduata Fabricius, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 8 mm; left antenna and left front leg broken.] Paralectotype, female! [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository.* Lectotype and paralectotype at ZMUC. *Type locality.* "Sumatra" (Indonesia).

*Cicindela triguttata* Herbst, 1806:172, fig. 5, new synonymy.

*Type status.* Lectotype, female [here designated]. *Type labels.* "3703" [typeset]; "Trigguttata, Ht.\* Dej., Ind. or. Dej., A.S. Mus. Ht." [handscript green label with black marginal line]; "Zool. Mus., Berlin" [typeset]; "LECTOTYPE, Cicindela, triguttata Herbst, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 7.5 mm; right mesepisternum, middle coxa and leg missing.] Paralectotypes, two males! each [here designated] labelled "Amer. sept., Mus. Herbst, Nr. 3703" [yellow label] are labelled "PARALECTOTYPE" [typed and handprinted red label]. [Four other possible syntypes! at MNHB bear different locality and number labels than the lectotype thereby making their syntypic status questionable.] *Type depository.* Lectotype and two paralectotypes at MNHB. *Type locality.* "Nordamerika" (North America, erroneous).

*Cicindela chlorochila* Chaudoir, 1852:25, new synonymy.

*Type status.* Lectotype, male [here designated]. *Type labels.* "42540" [typeset]; "chlorochila, Chaud. Hongkg." [handscript yellow label]; "Zool. Mus., Berlin" [typeset]; "LECTOTYPE, Cicindela, chlorochila Chaudoir, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 8.5 mm.] [Three other possible syntypic males! at MNHB labelled only "Zool. Mus., Berlin" [typeset], are not considered syntypes because they are otherwise unlabelled.] *Type depository.* Lectotype at MNHB. *Type locality.* "Hong-kong."

*Cicindela myrrha* Thomson, 1857a:129.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* ?NMNHP. *Type locality.* "Sarawack, Borneo" (Indonesia).

*Cylindera (Ifasina) triguttata* (Fabricius): Rivalier, 1961:142.

*Cylindera (Ifasina) triguttata* (Fabricius): Naviaux, 1985:72, fig. 21, 56, 88.

*Nomenclatural note.*—Horn (1897b), in explaining the confusing nomenclature of this species, considered *Cicindela viduata* Fabricius, 1801, conspecific with *C. holosericea* Fabricius, 1801, and separate from *C. triguttata* Herbst, 1806, based on superficial differences of maculation. However, our studies of the syntypes of *Cicindela viduata* Fabricius at ZMUC and *C. triguttata* Herbst at MNHB indicate that these two taxa are synonymous.

No syntype of *Cicindela holosericea* Fabricius is known to exist (Zimsen, 1964; O. Martin, personal communication, 1983); however, our concept of this taxon, based on numerous specimens! from Indonesia, shows it to be a separate species confined to that part of the Oriental biogeographic region (refer to 'Remarks' under the previous species for some diagnostic characters of *C. holosericea*).

The following published names have been associated with this species: *sex-maculata* Dejean, 1825:146; *parvula* Dejean, 1837:6; *stygica* Chaudoir, 1865:23; however, these were not described or figured and are thus unavailable.

*Diagnosis.*—Distinguished by the entirely dark metallic copper labrum; unmarked humeral elytral angle; elongate impunctate area surrounding discal dot, two others at lateral margin on apical half; uniformly dull greenish black elytra with small blue punctures, apically punctures wider and shallower, surrounded by iridescence; opaque femora.

*Description.*—*General habitus.* Body very small to small (7.5–8.5 mm); head and pronotum finely rugose, copper-green reflections dorsally blue-green laterally; elytra dull greenish black to copper-black, distinctive elongate impunctate discal area surrounding one dot, two others on apical half; body black to bluish purple ventrally. *Head.* Labrum dark, metallic copper; six to ten submarginal setae; short medial tooth at anterior margin, rounded bulge on each side; narrow medial raised line on labrum; genae glabrous; vertex finely rugose, 10 to 12 mostly complete, moderately raised, longitudinal rugae between each eye and midline; rugae arcuate at center of vertex forming a small distinctive area of concentric ridges. *Prothorax.* Pronotum sparsely setose laterally, numerous appressed setae originating from several irregular rows of small, shallow punctures close to edge; anterior reflexed margin of pronotum no more than feebly rugose medially, transverse ridges absent; dorsal surface with fine wavy rugae forming an irregular pattern except for a series of fine, slanted parallel ridges meeting at medial line; small, shallow setigerous punctures over most of proepisterna except for slightly wavy dorsal margin; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a small, circular pit medially; moderately and densely appressed setae on all pleura except mesepisterna. *Elytra.* Surface dull dorsally, diffuse metallic humeral area and on most specimens a minute shiny spot medially on basal third; elytral sculpturing granulate-punctate, numerous small blue punctures basally, wider, shallower surrounded by iridescence and on most specimens coalescing apically; maculae varied; three dots on most specimens on apical half (on some specimens a fourth small medial dot on middle third), anterior dot elongate at middle near lateral margin, middle dot irregularly shaped and surrounded mesad by an elongate impunctate area often narrowed by punctures which impinge on it, posterior dot elongate and meeting lateral margin at right angles subapically, on a few specimens a short trace of an apical extension at the margin; apical margin microsculptured, slightly rounded before a moderate sutural spine. *Abdomen.* Sterna covered by sparse hairs medially with slightly longer and denser setae laterally. *Legs.* Trochanters nonmetallic brownish testaceous, one subapical seta on each front and middle segment; femora metallic blue-green; tibiae and tarsomeres purplish black. *Male genitalia.* Aedeagus slender with apex abruptly tapering to a broad, truncated tip (Naviaux, 1985).

*Geographic variation.*—Body surface sculpturing and elytral maculation on specimens! from China and the Philippines differ to a degree from those of the Indian subcontinent and are assignable to *Cicindela chlorochila* Chaudoir. Pres-



ently, we consider these characters to fall within our concept of *Cicindela viduata* and have synonymized the two taxa. Further study of more specimens from throughout the Oriental biogeographic region may alter this synonymy.

*Distribution.*—(Fig. 53). Northern India (Uttar Pradesh, West Bengal, Meghalaya, Assam), Nepal and Bangladesh (Chittagong). Ranges eastward into China, Malaysia, Indonesia and the Philippines.

*Localities.*—INDIA: West Bengal: Asansol (IRSNB); 15 km N Siliguri, 250 m 3.VI.1985, forest path (DLPC, CMNH); Uttar Pradesh: 15 km N Dehra Dun, 29.VI.1983, forest path (DLPC, CMNH); Bihar: 60 km W Ranchi, 22.VI.1986, forest path (DLPC); Ranchi, 20.VI.1986, scrub forest (DLPC); Orissa: Simlipal National Park, 25.VI.1986, forest path; Assam: Nengba, 155 m, 20.V.1966 (CMNH). NEPAL: 15 km S Sauraha, 28.V.1986, forest path (DLPC); Parbat District: Dhawalagiri, Karkineta-Nagdana, 1600 m, 3.VII.1986 (JPC, CMNH); Bhadrapur, 120 m, 12.V.1984 (RNC, CMNH). VIETNAM: Quanloi, 20.IV.1922 (IRSNB); Cho-ganh (IRSNB); Quang Nam Province: Kim Lien, 5.VIII.1968 (CMNH); 1.6 km N Quang Tri, ultraviolet light, 30.VII, 29.VIII, 12.IX.1970 (NMNH); Hoa-binh, 6–9.VI.1986 (CMNH). BURMA: Teinzo, V.1886 (IRSNB). THAILAND: Khorat Province: 30 km S Pak Thong Chai, Coleman lantern, 12.IV.1967 (NMNH); Chiangmai, 28.V.1952, at light (NMNH). INDONESIA: Tengaron, Borneo, IV.1882 (IRSNB); Java: Central Java, Mount Oengaran (IRSNB); Tjilatjap, II.1918 (DEI); Sumbawa (IRSNB); Sulawesi (South Celebes): Pangie, 1.XI.1882 (AMNH); Depok, XII.1949 (CMNH). MALAYSIA: Perak, Perak Island (CMNH); Selangor Kepong, in forest, X.1949 (NMNH); Taiping, IV.1978 (CMNH). SINGAPORE: Singapore (DEI). CHINA: Hong-kong (MNH). PHILIPPINES: North Luzon (DEI); Los Baños (DEI); Biliran (DEI); Tangcolan, Bukidon (DEI); Laguna, Mount Makiling, 120 m, 1.VI.1931 (IRSNB).

*Ecology.*—Adults occur on open areas on the floor of secondary and primary forests at 200 to 1000 m elevations and are attracted to lights. Although common along the forest trails of the Terai of Nepal, adults are difficult to capture because they blend with their surroundings and take long flights when disturbed (Naviaux, 1985).

### *Cicindela (Ifasina) viridilabris* Chaudoir

*Cicindela viridilabris* Chaudoir, 1852:24.

*Type status.* Syntypic females [only one syntype known (Maindron and Fleutiaux, 1905); unexamined; concept based on comparing specimens! labelled "India, Uttar Pradesh, 15 km NW Dehra Dun, 29.VI.1983, forest path", at CMNH with Chaudoir's original description]. *Type depository.* ?MNHN. *Type locality.* "Indes Oriental" (undoubtedly northern India).

*Cylindera (Ifasina) viridilabris* (Chaudoir): Rivalier, 1961:142.

*Cylindera (Ifasina) viridilabris* (Chaudoir): Naviaux, 1985:72, fig. 20, 55.

*Diagnosis.*—Distinguished by the several broad rugae on the vertex of the head; metallic labrum; diffuse iridescent humeral angles; four elytral maculae alternating in medial and lateral positions; contrasting blue-green elytral punctures; large setigerous punctures at lateral pronotal margins and covering proepisterna.

*Description.*—*General habitus.* Body very small to small (6.5–8 mm); head and pronotum dark bronze dorsally (on a few specimens blue-green predominates), shiny blue-green laterally; elytra dark brown to black with blue-green contrasting elytral punctures, a diffuse shiny humeral angle and lateral area, maculae as four small spots on disc alternating in medial and lateral positions; body ventrally blue-green. *Head.* Labrum short, copper-green; one medial tooth; medial carina absent; frons somewhat coarsely rugose medially; 8 to 11 mostly complete rugae on vertex between each eye and midline; frons, vertex and genae glabrous. *Prothorax.* Pronotum with moderately raised and irregular rugae on disc, laterally with multiple rows of numerous large setigerous punctures; proepisterna covered by dense, large setigerous punctures. *Pterothorax.* Female mesepisternal coupling sulcus a moderately deep groove (forming a pit on some females) along posterior margin. *Elytra.* Dark brown to black on disc, blue-green contrasting elytral punctures; diffuse shiny blue-green lateral area from humeral angle to middle; four small, yellow spots representing apical end of humeral angle, each end of a divided middle band (thin joining line evident on some specimens), and basal enlargement of apical lunule;



apex microserulate; apical margin slightly and separately rounded; sutural spine moderately long. *Abdomen*. Anterior four sterna laterally with moderate, appressed setae, fifth sternum laterally and all sterna medially finely hairy. *Legs*. Trochanters nonmetallic dark brown, one subapical seta on each front and middle segment; femora metallic blue-green and purple; tibiae and tarsomeres purple. *Male genitalia*. Aedeagus short, narrow at base then abruptly enlarged at middle and tapering gradually to a short acute apex; small sclerotized beak not displaced to the right in left lateral aspect.

*Distribution*.—(Fig. 55). Northern India (Haryana, Punjab, Himachal Pradesh, Uttar Pradesh, Madhya Pradesh, Orissa, Bihar) and Nepal.

*Localities*.—INDIA: Uttar Pradesh: 20 km NW Dehra Dun, 29, 30.VI.1983, forest path (DLPC, CMNH); Union Territory: Chandigarh, 30.VII.1982, forest path (DLPC); Himachal Pradesh: 6 km N Kalka, 17.VII.1982, rocky river bed (DLPC); Haryana: 10 km S Delhi, 3.VII.1982, forest path (DLPC, CMNH); Orissa: Simlipal National Park, 24, 25.VI.1986, scrub forest (DLPC); Bihar: Ranchi, 21.VI.1986, scrub forest (DLPC); 17 km N Hazaribagh, 21.VI.1986, scrub forest (DLPC). NEPAL: Chitwan Royal Park, 15 km S Sauraha, 28.V.1986, night light (DLPC); Koshi, Dharan, 18.V.1985 (JPC, CMNH).

*Ecology*.—Adults are restricted to moist areas shaded by vegetation taller than 2 m, such as gardens, rubber plantations, forest, and bamboo at low elevations up to 2000 m. Naviaux (1985) found them mating and flying along forest paths.

### *Cicindela (Ifasina) labioaenea* Horn, new rank

*Cicindela viridilabris* Bates, 1886:70 (preoccupied, Chaudoir 1852:24).

*Type status*. Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depositary*. ?MNHN. *Type locality*. "Ceylon" (Sri Lanka).

*Cicindela labioaenea* Horn, 1892a:79.

*Type status*. Lectotype, female [here designated]. *Type labels*. "Ceylon\*, Nietner, Mus. Berol." [handscript]; "Type!, Dr. W. Horn" [typeset within thin black border]; "DEI, EBERSWALDE" [typeset]; "LECTOTYPE, Cicindela, labioaenea W. Horn, by R.E. Acciavatti, '84" [typed and handprinted red label]. [Lectotype is 8 mm.] *Type depositary*. Lectotype at DEI. *Type locality*. "Ceylon" (Sri Lanka).

*Cicindela viridilabris fuscocuprascens* Horn, 1905a:60.

*Type status*. Lectotype, female [here designated]. *Type labels*. "Type" [typeset circular label with red border]; "Nilgiri Hills, H.L. Andrewes" [typeset separated by a yellow line]; "C. viridilabris var. nov., fusco-cuprascens m., type" [folded label with handscript by Walther Horn, last word underlined]; "Type" [typeset red label]; "LECTOTYPE, Cicindela, viridilabris fuscocuprascens, W. Horn by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 8 mm; left hind leg missing]. Paralectotype, female! [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depositary*. Lectotype at BMNH; paralectotype at DEI. *Type locality*. "Nilgiri Hills" (Tamil Nadu, India).

*Cicindela viridilabris labioaenea* Horn: Horn, 1905a:61.

*Cylindera (Ifasina) viridilabris labioaenea* (Horn): Naviaux, 1984b:68, fig. 21–23.

*Diagnosis*.—Distinguished by the numerous narrow rugae on vertex of head; metallic labrum; diffuse iridescent humeral elytral angles; four elytral spots alternating in medial and lateral positions (minute humeral dot on a few specimens); blue-green contrasting elytral punctures; large setigerous punctures at lateral pronotal margin and covering proepisterna.

*Description*.—*General habitus*. Body very small to small (7–8 mm); body slender; head and pronotum shiny copper-green and blue-green dorsally, bright blue and green lateral margins on some specimens expanded to dominate dorsal color; elytra dull copper-green to green, some specimens bronze; diffuse slightly shiny blue-green or copper-green humeral area hardly contrasting with remainder of elytra; four elytral spots on most specimens alternating in medial and lateral positions (minute dot at humeral angle on a few specimens); body blue or bluish green ventrally. *Head*. Labrum short, metallic bronze to copper with blue-green or purple reflections; five to nine submarginal setae; medial tooth short, blunt bulge on each side; frons with coarse, wrinkled surface, medially rugae arcuate and transverse,

laterally rugae vertical; 12 to 16 mostly complete, moderately raised, longitudinal rugae between each eye and vertex midline, rugae irregular medially; frons, vertex and genae glabrous. *Prothorax*. Pronotum with moderately raised and irregular rugae on disc and multiple rows of large setigerous punctures laterally; proepisterna covered by dense, large setigerous punctures. *Pterothorax*. Female mesepisterna with a deep elongate cavity along posterior margin. *Elytra*. Disc with large, deep contrasting blue-green punctures deepest basally becoming shallow and wide apically; humeral area diffuse shiny blue-green or copper-green; four yellow spots (minute dot at humeral angle on a few specimens) representing apical end of humeral lunule, each end of a divided middle band, and only the enlarged basal portion of apical lunule (a few specimens with a short marginal portion not attaining suture); apex microserulate, slightly rounded before a moderately long sutural spine. *Abdomen*. Sterna covered by fine hairs and appressed setae laterally. *Legs*. Trochanters nonmetallic reddish brown, one subapical seta on each front and middle segment; femora copper-green; tibiae and tarsomeres blue-green. *Male genitalia*. Aedeagus slender, widest at middle third and tapering gradually to a long, rounded tip (Naviaux, 1984b).

*Geographic variation*.—We recognize two subspecies of *Cicindela labioaenea*: nominal *C. labioaenea* has purple proepisterna whereas *C. labioaenea fuscocuprascens*, new combination, has copper proepisterna. Certain specimens of *C. labioaenea fuscocuprascens* from Bangalore, Karnataka, India, and populations tentatively assignable to this subspecies from eastern Andhra Pradesh, possess dark bronze proepisterna and a shiny green or copper elytra with expanded markings which on a few specimens include a small humeral dot, a divided middle band with elongate spots and intervening dots, and a slight expansion along the lateral margin for both the middle band and the apical lunule.

*Distribution*.—(Fig. 54). *Cicindela labioaenea labioaenea* is from Sri Lanka, whereas *C. labioaenea fuscocuprascens* occurs in western Tamil Nadu, southern Karnataka, and eastern Andhra Pradesh, India.

*Localities*.—*Cicindela labioaenea labioaenea*. SRI LANKA: Central Province: Kandy, V.1901, V.1953, VI.1908 (DEI); Kegalle, Kitulagala, 15.IV.1981 (DLPC); Ratnapura, Pompakele, 25.III.1981 (DLPC); Ratnapura, Ambalamehene, 4.IV.1981 (DLPC); Kandy District: Udawattakele, 26–30.III.1975, 8–11.V.1975 (CMNH). *Cicindela labioaenea fuscocuprascens*. INDIA: Karnataka: Bangalore, 916 m, 25.V.1980 (DLPC); Bangalore, 915 m, 8.VI.1984, forest path (DLPC); Mysore, 6.VI.1985 (DLPC); Chiknayakanhalli, 19.VIII.1986, scrub forest (DLPC); Chikmagalur, 17.VI.1984 (CMNH); Tamil Nadu: 25 km W Coimbatore, 18.VI.1983, pond edge (DLPC); Coimbatore, 430 m, VI.1938, IX.1974, X.1976, XI.1986 (CMNH); Cinchona, V.1957 (CMNH); Andhra Pradesh: 20 km N Narsipatnam, 28.VI.1986, scrub forest (DLPC); 60 km NW Tuni, 1.VII.1986, scrub forest (DLPC); Araku, 900 m, 29.VI.1986, scrub forest (DLPC).

*Ecology*.—Adults occur on moist areas of scrub to primary forest.

*Remarks*.—*Cicindela (Ifasina) labioaenea* should be separated from *C. (Ifasina) viridilabris* because of their differently formed female coupling sulci. Moreover, because *Cicindela (Ifasina) labioaenea* and *C. (Ifasina) fuscocuprascens* differ morphologically only by proepisternal color, they are conspecific and the new subspecific rank *C. labioaenea fuscocuprascens*, new combination, proposed.

### *Cicindela (Ifasina) fallaciosa* Horn, new rank

*Cicindela fallaciosa* Horn, 1897b:57.

*Type status*. Lectotype, female [here designated]. *Type labels*. “Teinzo, Birmania, Fea. Maggio 1886” [typeset within thin black border]; “Type!, coll. W. Horn” [typeset within thin black border]; “DEI, EBERSWALDE” [typeset]; “LECTOTYPE, Cicindela, fallaciosa W. Horn, by R.E. Acciavatti, '84” [typed and handprinted red label]. [Lectotype is 7.5 mm.] *Type depository*. Lectotype at DEI. *Type locality*. “Teinzo, Burma” (Kachin State, Burma).

*Cicindela viridilabris fallaciosa* Horn: Horn, 1926:168.

*Diagnosis*.—Distinguished by the metallic labrum with large, broad medial carina; distinctive iridescent humeral crescent; four elytral maculae alternating in

medial and lateral positions; blue contrasting elytral punctures; setose lateral pronotal margin with numerous small punctures in multiple rows; proepisterna densely covered by small setigerous punctures.

*Description.*—*General habitus.* Body very small to small (7–8 mm); head and pronotum dorsally copper, laterally shiny blue-green and violet; elytra dull dark brownish-black; distinctive shiny blue-green humeral elytral crescent; small shallow blue punctures basally, obscure apically; maculae as four spots alternating in medial and lateral positions on the disc; ventrally body blue or bluish green. *Head.* Labrum dark, metallic copper with one medial tooth and a large, broad medial carina; frons with moderately coarse transverse rugae and two or three longitudinal rugae at sides extending onto vertex; 12 to 14 mostly complete rugae between each eye and vertex midline; frons, vertex and genae glabrous. *Prothorax.* Numerous lateral pronotal setae originating from small punctures in multiple rows; proepisterna dark blue; small dense setigerous punctures scattered throughout except along extreme dorsal margin. *Pterothorax.* Female mesepisternal coupling sulcus a shallow, medial groove slightly deeper at middle. *Elytra.* Surface densely shallowly punctured; blue punctures contrasting with dark background on anterior half but scarcely evident on apical half; shiny blue-green crescent at humeral angle, remainder of lateral margin dark, no more than narrowly shiny near apex; four yellow-white spots on most specimens (a minute dot at lower margin of humeral angle on a few specimens); anterior spot circular corresponding to apical end of humeral lunule; middle spots are divided ends of middle band; posterior spot is basal enlargement of apical lunule; small microsculptulations; apical margins evenly rounded on male, more separately rounded on female; small sutural spine. *Abdomen.* Sterna covered by fine hairs and appressed setae laterally. *Legs.* Trochanters nonmetallic reddish brown, one subapical seta on each front and middle segment; femora copper-green; tibiae and tarsomeres blue-green. *Male genitalia.* Not examined.

*Geographic variation.*—Specimens from Southeast Asia and China possess elytra with discrete punctures throughout and on a few specimens divided ends of middle band narrowly joined by a thin line.

*Distribution.*—(Fig. 59). Occurs in eastern Bangladesh and ranges eastward into Southeast Asia.

*Localities.*—BANGLADESH: Chittagong Hill Tracts: Manimukh, 5.V.1965, on teak (CMNH). BURMA: Tienzo, V.1886 (DEI). VIETNAM: Tonkin, Montes Mauson, IV–V, 615 to 925 m (DEI); 0.6 km N Quang Tri, ultraviolet light, 29.VIII.1970 (NMNH).

*Ecology.*—The habitat of this species is unreported but probably similar to *Cicindela severini* and other related species whose adults dwell in forests. Adults are active from April through August and also are attracted to black light.

### *Cicindela (Ifasina) severini* Horn, new rank

*Cicindela severini* Horn, 1892c:537.

*Type status.* Holotype, male! [by monotypy]. *Type labels.* “Barway, P. Cardon” [typeset within thin black margin]; “C. Severini m., Nsp. typ!” [handscript by W. Horn]; “TYPE” [typeset on pink label to left side of a central line]; “cf. Ann. Soc. Ent., Belg. 1892 p. 537” [handscript]; “C. Severini Horn, det. W Horn” [first line handscript, second typeset]; “Holotype, by monotypy in, original description, cf. 1985 ICZN 73a(ii)” [red label with first line typed, remainder handscript]; “Cicindela, severini W. Horn, seen by R.E. Acciavatti, '83” [handprinted]. [Head and pronotum have been glued onto body.] [A second male! at DEI, labelled in part “Type!, Dr. W Horn”, also a candidate for the holotype of this species, is treated as an ordinary specimen to which we believe Horn attached a printed label presumably because he considered it adequately represented the holotype. Selection of the specimen at IRSNB to bear the holotype label was made on the basis of the second label handwritten by Walther Horn.] *Type depository.* Holotype at IRSNB. *Type locality.* “Barway” (Bihar, India).

*Cicindela viridilabris severini* Horn: Horn, 1905a:61.

*Cicindela nathanae* Mandl and Wiesner, 1975:94, new synonymy.

*Type status.* Holotype, female! [erroneously cited as a male in the original description]. *Type depository.* Holotype in JWC. *Type locality.* “India, Mysore, Shimoga District, Agumbe Ghat, 600 m” (Karnataka, India).

**Diagnosis.**—Distinguished by the lack of pronotal setae and contrasting elytral punctures; metallic labrum; iridescent humeral angle and four elytral maculae alternating in medial and lateral positions.

**Description.**—*General habitus.* Body very small to small (7–8 mm); head and pronotum shiny, copper dorsally, purple and blue-green laterally, on some specimens these colors predominate dorsally (a few males melanic); elytra dull brownish black except for an iridescent blue-green humeral crescent, minute noncontrasting punctures to impunctate disc, a thin iridescent lateral line and copper apex with maculae comprised of four dots alternating medially and laterally on disc; body purple-black ventrally. *Head.* Labrum metallic copper, one medial tooth, sinuate anterior margin; six submarginal setae, medial carina absent, only a thin raised medial line anteriorly; frons finely rugose medially; vertex of head, 10 to 12 nearly complete rugae between eye and midline. *Prothorax.* Pronotum laterally nearly glabrous except for a few inconspicuous hairs; anterior reflexed margin of pronotum with weak rugae or irregular wavy reticulations somewhat slanting and merging with rugae of disc, all converging at a feeble midline; proepisterna with sparse, small setigerous punctures, absent dorsally on most specimens. *Pterothorax.* Female mesepisternal coupling sulcus a moderately deep elongate depression, small circular pit medially on some specimens. *Elytra.* Elytral surface dull brown-black (a few males melanic); minute punctures deepest basally, nearly impunctate apically; iridescent blue-green crescent at humeral angle; thin iridescent edge laterally; apex copper; yellow white spots representing apical end of humeral lunule, ends of divided middle band (on a few specimens almost joined by a thin line), only the basal enlargement of apical lunule; apex finely microserrulate; apical margins slightly rounded just before suture; spine short. *Abdomen.* Sterna purple-black; moderate, appressed setae laterally, fine hairs medially. *Legs.* Trochanters pale testaceous, one subapical seta on each front and middle segment; femora metallic purple-green with distal end bronze; tibiae and tarsomeres purple. *Male genitalia.* Aedeagus slender and widest on middle third, tapering gradually to a rounded apex which ends with a small rounded beak.

**Geographic variation.**—Some specimens from eastern Andhra Pradesh, India, have a purple and blue-green head and pronotum, and a few individuals have the middle and apical lunules expanded along the lateral margin for a short distance. A melanic male with all color replaced by black or purple-black was collected with typical specimens 65 km W Ranchi, Bihar, India.

**Distribution.**—(Fig. 54). Central India (Bihar, Orissa, Andhra Pradesh, Maharashtra, Goa, Karnataka).

**Localities.**—INDIA: Bihar: Barway (IRSNB); 17 km N Hazaribagh, 21.VI.1986, scrub forest (DLPC); 20 km S Palamau, 21.VI.1986, scrub forest (DLPC); 65 km W Ranchi, 23.VI.1986, scrub forest (DLPC); Karnataka: Shimoga District, Agumbe Ghat, 615 m, V.1981 (CMNH); 14 km E Dandeli, 12.VI.1984, 700 m, road (DLPC); 5 km N Mudigere, 5.VI.1984, forest path (DLPC); Mudigere, 9.VI.1986, forest path (DLPC); 35 km NE Bantyal, 5.VI.1984, 200 m, road cut (DLPC); 7 km E Sulya, 4.VI.1984, 150 m, road (DLPC); Goa: 54 km E Panaji, 13.VI.1984, forest path (DLPC); 56 km E Panaji, 17.VII.1986, forest path (DLPC); Maharashtra: 10 km W Thane, 28.VI.1985, forest path (DLPC); 20 km E Savantvadi, 16.VII.1986, forest path (DLPC); 5 km E Ajra, 16.VII.1986, forest path (DLPC, CMNH); Andhra Pradesh: Araku, 900 m, 29.VI.1986, scrub forest (DLPC); 65 km N Waltair, 29.VI.1986, scrub forest (DLPC); Orissa: Mayurbhanj District, Simlipal National Park, 25.VI.1986, forest path (DLPC).

**Ecology.**—Adults occur along forest paths and roads during May, June and July.

### *Cicindela (Ifasina) collicia*, new species

**Diagnosis.**—Distinguished by the metallic labrum with a narrow pigmented medial carina; iridescent crescent at humeral angle; four elytral maculae alternating in medial and lateral positions; blue-green contrasting elytral punctures; sparsely setose lateral pronotal margins; small setigerous punctures ventrally on proepisterna.

**Description.**—*General habitus.* (Fig. 29). Body very small to small (7.5–9.5 mm); body slender; head and pronotum copper-brown with green lateral reflections dorsally; distinctive iridescent blue-green

humeral elytral crescent; four small spots alternating in medial and lateral positions from base to apex; body ventrally shiny blue-green. *Head*. Labrum metallic copper, one medial tooth and a sinuate anterior margin; six to eight submarginal setae; medial carina narrow, thin pigmented extension of margin along a medial line for nearly the entire longitudinal dimension; frons finely, transversely rugose medially, numerous longitudinal rugae laterally extend onto vertex; 12 to 16 mostly complete rugae between each eye and vertex midline; frons, vertex, genae glabrous; numerous rugae on genae converging anteriorly; only distal segment of maxillary palpi and distal two segments of labial palpi metallic green; mandibles ivory dorsolaterally for most of their length on male and along basal half on female; antennal scape with one seta. *Prothorax*. Dorsal outline quadrate, sides nearly parallel on female, more rounded on male; pronotum shiny, copper on dorsum, green and blue laterally, with sparse, conspicuous appressed setae originating from a few to many small irregularly arranged punctures submarginally at sides; anterior reflexed margin of pronotum with transverse rugae not merging with slanting rugae on disc meeting along a feeble center line; proepisterna with sparse, small setigerous punctures which are often lacking dorsally; prosternum glabrous (a few specimens with one seta). *Pterothorax*. Female mesepisterna smooth, glabrous with a shallow, circular pit type coupling sulcus medially; male mesepisterna with only a few setae at posteroventral margin; metepisterna sparsely setose. *Elytra*. Sides subparallel, widest at middle; elytral surface dull, dark copper-brown, densely granulate-punctate basally with small punctures shallower apically, blue-green punctures contrasting with dark background over entire surface; distinctive iridescent blue-green crescent at humeral angle; four yellow spots representing apical end of humeral lunule, each end of a divided middle band and only the basal enlargement of apical lunule; apical margin microserrulate; apices cojointly rounded; small sutural spine. *Abdomen*. Laterally with moderately dense setae; medially glabrous except for sparse, fine hairs. *Legs*. Coxae with long setae; trochanters nonmetallic purple-brown, one subapical seta on each front and middle segment; tibiae and tarsomeres metallic iridescent with sparse erect setae and spines. *Male genitalia*. Aedeagus moderately enlarged, widest and nearly of uniform width on apical half before tapering abruptly to a short sclerotized and broadly rounded apex, not displaced to the right side in left lateral aspect.

*Body size*. — *Holotype*. Body length 9.2 mm, elytral width 3.2 mm. *Allotype*. Body length 8.1 mm, elytral width 2.8 mm.

*Type locality*. — Cinchona, Anaimalai Hills, Tamil Nadu, India.

*Type specimens*. — Holotype, female labelled "INDIA: Tamil Nadu: Anaimalai Hills, Cinchona 3500 ft, V.1976, Nathan, leg." [handprinted]. Male allotype, 15 paratypes labelled same as holotype. One hundred twenty-two paratypes from the following localities: same label data as holotype but taken "IV.1974, IV.1967, V.1966, V.1964, V.1963, IV.1960, V.1960, V.1957, V.1956"; "INDIA: Tamil Nadu: Anaimalai Hills, Topslip 2500 ft, V.1977"; "INDIA: Tamil Nadu: Nilgiri Hills, Devala 3200 ft, V.1984"; "INDIA: Tamil Nadu: Nilgiri Hills, Cherangode 3500 ft, V.1950"; "INDIA: Tamil Nadu: Nilgiri Hills, Gudalur 3500 ft, IV.1949"; "INDIA: Tamil Nadu: Mango Range, 3500 ft, V.1949"; "INDIA: Tamil Nadu: Coimbatore, VI.1937"; "INDIA: Tamil Nadu: Coimbatore, 18.V.1913"; "INDIA: Tamil Nadu: Coimbatore, X.1960"; "INDIA: Kerala: Trivandrum District, Poonmudi Range, 3000 ft, V.1972"; "INDIA: Kerala: Kottayam, IX.1974"; "INDIA: Kerala: Kottayam District, Peermade 4200 ft, V.1975"; "INDIA: Kerala: Trivandrum, Wallardi, 9.V.1903"; "INDIA: Kerala: Periyar 1000 m, forest path, 14-16.VI.1984"; "INDIA: Kerala: Trichur, forest path, 20.VI.1983."

*Type depository*. — Holotype, allotype and 37 paratypes at CMNH. Remaining 100 paratypes distributed as follows: 25 to DLPC; 26 to RMC; 8 to CNCO; 7 to ITZA; 6 to AMNH; 5 to JWC; 4 to FCC; 3 to HBC; 2 each to NMNH, BMNH, UMDE, DEI, CASS, FCAG, KWVC; 1 each to JGC and IARI.

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Fig. 29. — *Cicindela (Ifasina) collicia*, new species, female holotype from Cinchona, Anaimalai Hills, Tamil Nadu, India. (Body size, 9.2 mm.)





*Etymology.* — The name is feminine singular and derived from the Latin *collicia* (gutter on a roof or channel in a field) with reference to the arrangement of the numerous moderately raised rugae on the vertex of the head.

*Distribution.* — (Fig. 54). Southern India (Tamil Nadu, Kerala, Karnataka).

*Localities.* — In addition to the localities listed for the type series, specimens! have been collected at: INDIA: Karnataka: Coorg District, Mercara, 1230 m, V.1973 (CMNH); 43 km E Sulya, 890 m, 4.VI.1984, road cut (DLPC); Mudigere, 17.V.1986, forest path (DLPC); 10 km SE Sringeri, 18.V.1987, forest path (DLPC); Kerala: Quilon District, Tenmalai, 170 m, V.1985 (CMNH); Tamil Nadu: Madurai District, Kumili, 770 m, V, VI.1986 (CMNH). All specimens! were collected in April, May and June except two most likely erroneously labelled September and October.

*Ecology.* — Adults frequent the moist forest floor and road cuts during the south-west monsoons from April to June.

*Remarks.* — Previously considered by most authors to be *Cicindela viridilabris severini*, populations from the southern end of the Western Ghats of southern India represent a separate new species. Differences for the female coupling sulcus, sculpture of the head, lateral pronotal setae, punctures of the proepisterna and elytral sculpture distinguish *Cicindela collicia* from both *C. viridilabris* and *C. severini*, both of which occupy more northern ranges in India.

### *Cicindela (Ifasina) nietneri* Horn

*Cicindela nietneri* Horn, 1894b:220.

*Type status.* Holotype, male! [by original description]. *Type depository.* Holotype at DEI. *Type locality.* "Ceylon" (Sri Lanka).

*Cylindera (Ifasina) nietneri* (Horn): Naviaux, 1984b:68, fig. 24–26.

*Diagnosis.* — Distinguished by the metallic labrum; four elytral maculae alternating in medial and lateral positions; dull purple-black body.

*Description.* — *General habitus.* Body very small (7–7.5 mm); body quite slender with elytra parallel sided; head and pronotum dull purple-black dorsally and slightly shiny purple-green laterally; elytra purple-black with four circular spots alternating in medial and lateral positions on the disc; ventral surface of body purple, blue and greenish blue. *Head.* Labrum short, dark metallic bronze-purple; six submarginal setae; short medial tooth at anterior margin; antennal scape with one subapical seta; 10 to 12 mostly complete rugae between each eye and vertex midline; frons, vertex and genae glabrous. *Prothorax.* Pronotum anterior reflexed margin narrow, flattened, rugae mostly transverse; short transverse rugae at middle of disc, irregular laterally; large setigerous punctures near lateral pronotal margin irregularly arranged; proepisterna covered by large, setigerous punctures; prosternum green, glabrous. *Pterothorax.* Male mesepisterna glabrous except for setae at posteroventral margin; other pleura and sterna covered by sparse setae except for extreme middle of metasternum. *Elytra.* Small, shallow, noncontrasting purple puncture basally, nearly impunctate with purple speckling apically; four circular, yellow spots alternating in medial to lateral positions on the disc; apex microserrulate; sutural spine small. *Abdomen.* Sterna covered by fine hairs and appressed setae laterally on all sterna. *Legs.* Trochanters nonmetallic dark brown, one subapical seta on each front and middle segment; femora metallic copper and blue-green; tibiae and tarsomeres purple. *Male genitalia.* Aedeagus slender with apex tapering evenly to a point (Naviaux, 1984b, fig. 25).

*Distribution.* — (Fig. 54). Sri Lanka and India (Andhra Pradesh).

*Localities.* — SRI LANKA: Northwest Province: Kurunegala, 14.VIII.1979 (RNC). INDIA: Andhra Pradesh: Araku Valley, 900 m, 23.VIII.1986 (DLPC).

*Ecology.* — Naviaux (1984b) found adults of this species mixed with those of *Cicindela labioaenea*; however, *C. nietneri* appears to be quite rare as his recent extensive collecting throughout Sri Lanka resulted in only one male specimen. Adults have been collected in moist habitats during August.



*Remarks.*—Fowler (1912) considered this species to be superficially indistinguishable from *Cicindela viridilabris*. From our study of the holotype, there is little doubt that this species is most closely related to *Cicindela labioaenea* from which it differs in size, shape and dorsal color. Apparently, only males of *C. nietneri* are known. Remarkably, one male! from India, Andhra Pradesh, Araku Valley, 900 m, 23.VIII.1986, in DLPC, agrees with our concept of this species. Notwithstanding the slightly different aedeagus form for these two species, we consider it possible that *Cicindela nietneri* may be a melanic form of *C. labioaenea* which occurs in southern India as the subspecies *C. labioaenea fuscocuprascens*. However, until this relationship between the two species is studied further through more extensive collecting and examination, we agree with Naviaux (1984b) and retain *Cicindela nietneri* as a separate species.

### *Cicindela (Ifasina) belli* Horn

*Cicindela belli* Horn, 1894a:174.

*Type status.* Lectotype, female [here designated]. *Type labels.* "Type" [typeset circular label with red border]; "Belgaum, Bombay" [typeset separated by a yellow line]; "Andrewes, Bequest., B.M. 1922-221." [typeset]; "Cicindela Belli Type Horn" [handscript]; "Belgaum" [typeset]; "LECTOTYPE, Cicindela, belli W. Horn, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 7.5 mm.] Paralectotypes, two females! and one male!, at DEI each [here designated] labelled "PARA-LECTOTYPE" [typed and handprinted red label]. [Additional syntypes at BMNH (G. G. Kibby, personal communication, 1983); unexamined.] *Type depository.* Lectotype at BMNH; three paralectotypes at DEI. *Type locality.* "Nord-Canara and Belgaum" (North Kanara, Karnataka, India).

*Cylindera (Ifasina) belli* (Horn): Rivalier, 1961:142.

*Diagnosis.*—Distinguished by the copper metallic labrum; diffuse iridescent elytral humeral angles; three or fewer elytral spots; dull, sparsely punctured, elongate area on disc surrounding largest spot; small dense setigerous punctures over most of proepisterna.

*Description.*—*General habitus.* Body very small to small (7–8 mm); head and pronotum shiny bronze-black to copper-green dorsally and blue-green laterally, on a few specimens blue-green predominates; elytra shiny bronze-black except for a dull, longitudinal area on disc with fewer punctures, laterally with diffuse metallic copper, green, bronze, blue and purple iridescence; elytra on most specimens with three or fewer dots; body ventrally shiny black on thorax and purplish black on abdomen. *Head.* Completely glabrous; labrum short, metallic copper on most specimens, blue on some specimens; anterior labral margin sinuate, one small tooth medially; six to eight submarginal setae; 12 to 16 mostly complete rugae between each eye and vertex midline. *Prothorax.* Pronotal surface glabrous; moderately impressed rugae, parallel medially and on anterior reflexed margin, irregular laterally; extreme lateral pronotal edge smoother, entirely glabrous on some specimens, sparsely setose on other specimens with setae originating from a few to many moderately large, deep and irregularly arranged punctures; proepisternal surface smooth, small dense setigerous punctures only on ventral two-thirds, on most specimens absent or sparse dorsally; anterior and posterior transverse sulci shallowly impressed, posterior one more so; minute shallow pit at posterior end of pronotal medial line. *Pterothorax.* Female mesepisternal coupling sulcus a moderately deep elongate pit or short groove medially along posterior margin. *Elytra.* Disc dull bronze-black, distinctive irregularly shaped, longitudinal and slightly impunctate black area anterior to (on some specimens surrounding) medial dot; laterally shiny purple, copper-green and bronze band from humeral angle to beyond middle with bronze color extending toward disc on basal third; elytral surface with blue-green punctures moderately dense throughout but deeper basally; punctures discrete on some specimens, surrounded by iridescence on other specimens; pale yellow dots varied in size, shape and number from one to four; maculae on most specimens representing extremities of a divided middle band (medial dot on most specimens present but on a few specimens lateral dot absent), enlarged basal portion of apical lunule (nearly complete on a few specimens); small dot representing extreme apical end of humeral lunule on a few specimens; elytral apices microserrulate; sutural spine small. *Abdomen.* Sterna laterally with moderate appressed setae; anterior two sterna with fine, longitudinal grooves, glabrous toward coxal margin,

remaining sterna lacking grooves and covered by fine, short hairs medially. *Legs.* Trochanters shiny black, one subapical seta on each front and middle segment; femora metallic copper to copper-green except for black-bronze distal end; tibiae and tarsomeres shiny, pitchy black and purple. *Male genitalia.* Aedeagus narrowed at base, abruptly widened at middle then nearly of uniform width on apical third and tapering abruptly to a wide, blunt point slightly displaced to the right side in left lateral aspect.

*Geographic variation.*—Specimens from the type locality have dark, shiny bronze-black elytra with sharply defined green punctures and interpunctural areas appearing polished, whereas specimens from localities further south along the Western Ghats have copper to copper-green elytra with shallow punctures surrounded by iridescence and interpunctural areas dull. The different elytral punctures between populations are most obvious on the apical third. Subspecific recognition of these southern populations of *Cicindela belli* must await study of more material throughout the entire range of this species.

*Distribution.*—(Fig. 55). Southern and central India (Bihar, Orissa, Madhya Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu).

*Localities.*—INDIA: Kerala: Wallardi (Travancore), V.1903 (CMNH); Chembra Peak Area, 1075 m, V.1970 (CMNH); Kottayam District, Peermade, 1290 m, V.1975 (CMNH); Chembra Peak Area, 1075 m, V.1970 (CMNH); Periyar, 1000 m, 14–16.V.1984, forest path (DLPC, CMNH); Valparai, 1200 m, 20.V.1985, night light (DLPC); Tamil Nadu: Anaimalai Hills, Cinchona, 1075 m, V.1976 (CMNH); Mudumalai Refuge, 14.VI.1983, forest path (DLPC); Nilgiri Hills, Gudalur, 1075 m, IV.1949 (CMNH); Nilgiri Hills, Devala, 985 m, V.1984 (CMNH); Karnataka: Coorg District, Mercara, 430 m, V.1973 (CMNH); 14 km E Dandeli, 12.VI.1984, 700 m, road cut (DLPC, CMNH); 35 km NE Bantyal, 200 m, 5.VI.1984, road cut (DLPC); 43 km E Sulya, 890 m, 4.VI.1984, road cut (DLPC); 5 km N Mudigere, 5.VI.1984, forest path (DLPC); 40 km SW Hassan, 3.VI.1984, forest path (DLPC); 12 km E Chikmagalur, 17.VI.1984, moist creek bed (DLPC); 20 km SW Chikmagalur, 850 m, 6.VI.1984, forest path (DLPC); 5 km NW Mysore, 24.VI.1984, forest path (DLPC); Maharashtra: 10 km W Thane, 28.VI.1985, forest path (DLPC); Orissa: Simlipal National Park, 24, 25.VI.1986, forest path (DLPC, CMNH); Bihar: Ranchi, 20.VI.1986, scrub forest (DLPC); 17 km N Hazaribagh, 21.VI.1986, forest path (DLPC).

*Ecology.*—Adults prefer shaded moist areas with 2 m or taller vegetation. During the southwest monsoon season, adults regularly occur on more open areas.

### *Cicindela (Ifasina) umbropolita* Horn

*Cicindela belli umbropolita* Horn, 1905a:61.

*Type status.* Lectotype, male [here designated]. *Type labels.* “Co-, type” [typeset on circular label with green border]; “Nilgiri Hills, H.L. Andrewes.” [typeset separated by a yellow line]; “Nilgiri Hills” [typeset]; “Andrewes, Bequest., B.M. 1922-221.” [typeset]; “802” [handprinted in red ink]; “Cicindela Belli Horn v. umbropolita (W. Horn) Horn” [handscript]; “LECTOTYPE, Cicindela, belli umbropolita, W. Horn by R.E. Acciavatti, '83” [typed and handprinted red label]. [Lectotype is 7.5 mm; glued to a point; broken left antenna and right hind leg.] Paralectotypes, two females! at IRSNB, and one female! and four males! at DEI, each [here designated] labelled “PARALECTOTYPE” [typed and handprinted red label]. [Twenty more syntypes at BMNH (G. G. Kibby, personal communication, 1983); unexamined.] *Type depository.* Lectotype at BMNH; two paralectotypes at IRSNB; five paralectotypes at DEI. *Type locality.* “Nilgiri Hills” (Tamil Nadu, India).

*Cicindela umbropolita* Horn: Fowler, 1912:345.

*Cylindera (Ifasina) umbropolita* (Horn): Rivalier, 1961:142.

*Diagnosis.*—Distinguished by the glossy black lateral elytral margins; unmarked elytral humeral angles; nearly glabrous proepisterna; opaque metallic femora; metallic copper labrum.

*Description.*—*General habitus.* Body very small to small (7.5–8 mm); body slightly robust, head and pronotum copper basally, blue-green anteriorly and laterally; elytral disc a mixture of metallic green punctures superimposed on shiny copper and dull black areas, laterally with shiny black margins which project medially and one or two small dots on disc; body ventrally shiny purplish black. *Head.*

Labrum short, dull metallic copper with darker margins, five to eight submarginal setae and one medial tooth which extends from a short, slightly raised ridge at anterior margin; frons with fine transverse rugae medially; 15 to 18 mostly complete, moderately raised longitudinal ridges between each eye and vertex midline; eyes bulging; genae glabrous. *Prothorax*. Pronotal surface glabrous; moderately impressed parallel rugae at middle and on anterior reflexed margin, irregular laterally; proepisterna nearly glabrous except for scattered setae near coxal margin (a few scattered setae originating from small punctures dorsally on a few specimens). *Pterothorax*. Female mesepisternal coupling sulcus a deep cavity medially along posterior margin. *Elytra*. Dorsally with dull, black areas most evident as a narrow subsutural band mixed with shiny copper areas, entire surface with bright green punctures shallow apically; lateral elytral margins shiny black, almost polished, tapering at each end and projecting medially as a thin band and isolated patch mesad on basal third; on a few specimens the anterior patch is broadly connected to the black lateral margin; transparent dot at end of black medial projection and second dot mesad on apical third, on some specimens a third dot mesad on basal third, although all these dots are faint; apex microserulate; small sutural spine. *Abdomen*. Sterna covered by fine hairs; anterior three sterna on female and four on male with sparse, appressed setae. *Legs*. Trochanters nonmetallic pale testaceous, one subapical seta on each front and middle segment; femora metallic copper and blue-green except for a bronze distal end; tibiae and tarsomeres shiny purple. *Male genitalia*. Aedeagus narrow at base, enlarged abruptly and wide at middle, tapering gradually to a blunt, rounded point; small, sclerotized beak at apex not displaced to the right side in left lateral aspect.

*Geographic variation*. — Northern populations of this species, representing a new subspecies described below, have the shiny black lateral margin broadened with elongate bulges mesad at basal and middle thirds thereby giving most of the elytra a shiny black appearance.

*Distribution*. — (Fig. 55). Southern India (Maharashtra, Karnataka, Kerala, Tamil Nadu).

*Localities*. — INDIA: Maharashtra: 5 km W Ajra, 16.VII.1986, forest path (DLPC); Karnataka: Coorg District, Mercara, 1230 m, V.1973 (CMNH); 43 km E Sulya, 4.VI.1984, 890 m, road cut (DLPC); 7 km E Sulya, 4.VI.1984, 150 m, road cut (DLPC); 5 km N Mudigere, 5.VI.1984, forest path (DLPC); 20 km SW Hassan, 3.VI.1984, forest path (DLPC); 12 km E Chickmagalur, 17.VI.1984, moist creek bed (DLPC); 20 km SW Chickmagalur, 6.VI.1984, 850 m, moist creek bed (DLPC); 5 km NW Mysore, 24.VI.1984, forest path (DLPC); Kerala: Periyar, 1000 m, 14–16.V.1984, forest path (DLPC); Anaimalai Hills, Kadamparai, V.1963 (CMNH); Chembra Peak Area, 1075 m, V.1970 (CMNH); Tamil Nadu: Nilgiris District, Gudalur, 1075 m, IV.1949 (RMC); Cherangode, 1075 m, V.1950 (RMC); Mango Range, 1170 m, V.1949 (RMC); Naduvatan, 1845 m, VII.1950 (RMC); Nilgiri Hills, Naduvatam, 1845 m, VII.1950 (CMNH); Madurai District, Kumili, 770 m, VI.1986 (CMNH).

*Ecology*. — This species is restricted to the shaded forest floor. Adults are commonly collected along paths within forests between 800 and 1700 m elevation (Fowler, 1912).

*Remarks*. — *Cicindela umbropolita* can be considered distinct from *C. belli* even though females of each species have a similar type of coupling sulcus. Both species occur together at many localities without any evidence of interbreeding. Furthermore, adults of the former species have proepisternal setigerous punctures either small and sparse or absent, whereas adults of the latter species have numerous, large setigerous punctures covering most of the proepisterna.

### *Cicindela (Ifasina) umbropolita lucidinigrosa*, new subspecies

*Diagnosis*. — This distinctive form is clearly a subspecies of *Cicindela umbropolita* from which it differs by the broad, shiny black lateral margins of the elytra with two large bulges projecting medially.

*Description*. — *General habitus*. Similar to the nominal form in body size and shape, as well as sculpturing, color and setal patterns of the head, prothorax, and pterothorax; however, differing by the greater extent to which the shiny black elytral margins are expanded and project mesad onto the disc.

*Type specimens.*—Holotype, female labelled “SOUTH INDIA, Mysore State: Shimoga District, Agumbe Ghat, 2000 ft, V.1974, T.R.S. Nathan.” Male allotype same locality data as holotype but collected V.1981. Four female paratypes with the same locality data as the holotype except collected: V.1974 and VI.1981. Fifteen additional paratypes labelled “INDIA: Karnataka: 14 km E Dandeli, 12.VI.1984, 700 m; road cut.” Six additional paratypes from the following localities in Karnataka, India: Agumbe, 650 m, 8.VI.1987, forest path; 60 km S Belgaum, 475 m, 13.VI.1987, forest path; Jog Falls, 550 m, 10.VI.1987, forest path; 15 km W Sirsi, 11.VI.1987, forest path.

*Type depository.*—Holotype and 4 paratypes at CMNH; allotype to JWC; 1 paratype each to HBC and RMC; 19 paratypes to DLPC.

*Type locality.*—Agumbe Ghat, 615 m, Shimoga District, Karnataka, India.

*Distribution.*—(Fig. 55). Known only from west central Karnataka, India.

*Ecology.*—All specimens! collected during May or June from 100 to 650 m elevations along forest paths.

*Etymology.*—The name is feminine singular and derived from the Latin *lucid* (shiny), *nigro* (black), and *-osa* (full of) with reference to the wide black lateral margins of the elytra.

*Remarks.*—Intergrade populations between the two *Cicindela umbropolita* subspecies possess elongate medial bulges to the shiny black lateral elytral margins. Such specimens! have been taken at the following locations: INDIA: Karnataka: Mercara; 25 km W Kadur, 40 km SW Hassan; 5 km N Mudigere; 15 km W Mudigere; 50 km W Mudigere; 7 km E Sulya; 20 km SW Chikmagalur, 5 km NW Mysore; Maharashtra: Ajra.

### *Cicindela (Ifasina) ganglbaueri* Horn

*Cicindela ganglbaueri* Horn, 1892b:95.

*Type status.* Lectotype, female [here designated]. *Type labels.* “Felder, Ceyl., 8.60” [handscript]; “Type!, Dr. W Horn” [typeset]; “ex coll. Wien. Mus.” [handscript with red and blue lines on left side]; “Syntypus” [typeset red label]; “DEI, EBERSWALDE” [typeset]; “LECTOTYPE, *Cicindela, ganglbaueri* W. Horn, by R.E. Acciavatti, '84” [typed and handprinted red label]. [Lectotype is 11 mm; missing all appendages but antennal scapes, left middle and right front legs; head glued to pronotum.] *Type depository.* Lectotype at DEI. *Type locality.* “Ceylon” (Sri Lanka).

*Cylindera (Ifasina) ganglbaueri* (Horn): Rivalier, 1961:142.

*Diagnosis.*—Distinguished by the short, nonmetallic shiny brown labrum; humeral elytral dot on male (none on female) and three spots in a medial line on both sexes; female pronotum conical in shape widest posteriorly, glabrous; male mandibles with teeth aligned in the same plane; anterior three abdominal sterna densely setose laterally.

*Description.*—*General habitus.* Body medium (11–12 mm); body moderately slender; head and pronotum dorsally bright copper, laterally shiny bronze-green and purple; female pronotum conical, male pronotum sub-parallel; elytra dull, dark blackish green on disc, diffuse iridescent greenish blue along sutural and entire lateral margins; elytral maculae as three medial spots in a longitudinal row; body purple ventrally. *Head.* Eyes bulging; antennal scape with one subapical seta; male mandible not curved posteroventrally and penultimate tooth of left mandible not projecting forward; labrum short, shiny brown with six to eight submarginal setae and one small medial tooth; frons finely rugose medially; longitudinal rugae on vertex extending onto frons at its sides; genae glabrous. *Prothorax.* Pronotum with bright copper disc and violet to green anterior and posterior reflexed and lateral margins; pronotum entirely glabrous, elongate and conical on female, nearly parallel sided on male; proepisterna purple, polished with only a few erect setae at anterior and coxal margins; prosternum green, nearly glabrous except anterior to front coxae; pronotal surface with shallow transverse anterior and posterior sulci and numerous short transverse rugae on disc, rugae deeper on the female where they are deepest

close to each sulcus, rugae shallow and irregular laterally. *Pterothorax*. Female mesepisternal coupling sulcus a groove, deepest ventrally; metepisterna bright green with abundant, appressed setae laterally. *Elytra*. Elytral surface slightly granulate-punctate on disc, shallow noncontrasting punctures, nearly impunctate apically; female elytra with a shiny, polished green humeral angle and three white spots arranged on a longitudinal row on disc and a small, shiny dark polished densely punctured area behind anterior spot; male humeral elytral spot and three white spots arranged in a row medially; elytral apices slightly truncated; markings microserrulate; sutural spine small. *Abdomen*. Anterior three sterna with abundant, appressed setae laterally, covered by fine hairs medially. *Legs*. Trochanters reddish, one subapical seta on each front and middle segment; tibiae and tarsomeres metallic green. *Male genitalia*. Aedeagus long and moderately slender, gradually enlarging from basal third, widest on middle third, more abruptly tapering on apical third; long and uniformly wide, rounded and sclerotized apex; apical tip slightly displaced to the right side in left lateral aspect.

*Distribution*.—(Fig. 56). Sri Lanka (Galle and Colombo districts).

*Localities*.—SRI LANKA: Galle District: Kaneliya, 155 m, IV.1973, at black light (NMNH); Colombo District: Labugama, 120 m, V.1976 (NMNH, CMNH).

*Ecology*.—Adults are found at elevations of 100 to 200 m during April and May and are attracted to black light.

### *Cicindela (Ifasina) dormeri* Horn

*Cicindela dormeri* Horn, 1898b:198.

*Type status*. Lectotype, female [here designated]. *Type labels*. "Dormer, Kandy" [typeset, manuscript]; "Type!, coll. W Horn" [typeset within thin black border]; "Syntypus" [typeset red label]; "DEI, EBERSWALDE" [typeset]; "LECTOTYPE, *Cicindela, dormeri* W. Horn, by R.E. Acciavatti, '84" [typed and handprinted red label]. [Lectotype is 8 mm; missing most of right elytron and right hind leg; head glued to pronotum.] Paralectotype, male! [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depositary*. Lectotype and paralectotype at DEI. *Type locality*. "Kandy" (Sri Lanka).

*Cicindela dormeri* Horn: Fowler, 1912:324, fig. 144.

*Cylindera (Ifasina) dormeri* (Horn): Rivalier, 1961:142.

*Diagnosis*.—Distinguished by the glabrous pronotum; nearly glabrous abdominal sterna; short shiny brown nonmetallic labrum; humeral elytral dot (none on female) and three medial spots in a row.

*Description*.—*General habitus*. Body very small to small (7.5–8 mm); body slender; dorsum bright, head and pronotum shiny copper-red dorsally, blue-green and purple laterally; pronotum subparallel on both sexes; elytra with diffuse golden green iridescence on lateral and sutural margins which gradually merge with velvety, dark copper-brown disc; elytral maculae as three medial spots in a longitudinal line; body purple ventrally. *Head*. Antennal scape with a subapical seta; male mandibles curved posteroventrally, broad ventral bulge before apex, left mandible with penultimate tooth greater than half the length of the distal one and displaced anteriorly; labrum short, shiny brown with eight submarginal setae and a short medial tooth; frons finely rugose medially; longitudinal rugae on vertex extending onto frons at its sides; genae glabrous. *Prothorax*. Pronotal surface shiny, entirely glabrous; proepisterna nearly glabrous except for scant setae ventrally; prosternum glabrous anterior to front coxae. *Pterothorax*. Female mesepisternal coupling sulcus a posteriorly slanting groove deepest ventrally; metepisterna metallic green and only sparsely setose. *Elytra*. Elytral surface with discrete punctures deepest basally contrasting with velvety, dark copper-brown disc; male elytra with a humeral dot and three spots medially in a row; female elytral humeral angle polished, humeral dot absent, medial three spots in a row, small dark brown polished and densely punctured area on disc behind anterior spot. *Abdomen*. Surface almost entirely glabrous with anterior three sterna laterally sparsely setose, medially without fine hairs. *Legs*. Trochanters reddish, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic blue-green and purple. *Male genitalia*. Aedeagus long and slender, gradually enlarging from basal third, widest at middle third, rapidly tapering on apical third to a long, uniformly wide point; rounded and sclerotized apex slightly displaced to the right side in left lateral aspect.

*Distribution*.—(Fig. 56). Sri Lanka (Kandy District).

*Localities.* — SRI LANKA: Kandy District: Kandy, Udawattakele Sanctuary, 645 m, 20–30.VII.1976 (NMNH, CMNH).

*Ecology.* — Adults have been taken within forests at about 700 m during July.

***Cicindela (Ifasina) henryi* Horn**

*Cicindela henryi* Horn, 1925b:165.

*Type status.* Lectotype, male [here designated]. *Type labels.* “Type” [typeset circular label with red border]; “TYPUS” [typeset brown label]; “Horawupotana, Ceylon., 14-X-24” [handscript]; “Pres. by., Imp. Bur. Ent., Brit. Mus., 1925-494” [typeset]; “Cicindela, Henryi W. H., Dr. W. Horn det. 1925” [first two lines and ‘5’ handscript, remainder typeset]; “LECTOTYPE, Cicindela, henryi W. Horn, by R.E. Acciavatti, ‘83” [typed and handprinted red label]. [Lectotype is 8 mm; antennae broken; body pinned on a minute needle.] Paralectotype, female! at DEI [here designated] labelled “PARALECTOTYPE” [typed and handprinted red label]. *Type depository.* Lectotype at BMNH; paralectotype at DEI. *Type locality.* “Horawupotana, Ceylon” (Sri Lanka).

*Cylindera (Ifasina) henryi* (Horn): Rivalier, 1961:142.

*Cylindera (Ifasina) henryi* (Horn): Naviaux, 1984b:69, fig. 27–30.

*Diagnosis.* — Distinguished by the sparse lateral pronotal setae; short, shiny brown nonmetallic labrum; elytral dot (missing on some specimens) and three spots in a medial line; conical female pronotum.

*Description.* — *General habitus.* Body small (8 mm); body slender; dorsum bright copper on vertex of head and pronotal disc, shiny blue-green laterally; elytra bronze with contrasting blue-green punctures and three medial spots in a line; body copper to purple and green ventrally. *Head.* Antennal scape with one subapical seta; male mandibles with little ventral displacement and only a slight bulge before apex, left mandible with penultimate tooth less than half as long as distal one and only slightly distorted anteriorly; female mandibles normal; labrum short, shiny, dark brown and leathery with eight to ten submarginal setae and a short, blunt medial tooth; frons finely rugose medially; longitudinal rugae on vertex extending onto frons at its sides; genae glabrous. *Prothorax.* Pronotum laterally with two rows of appressed setae originating from setigerous punctures, disc glabrous; propisterna smooth and glabrous except for sparse, erect setae ventrally and anteriorly; prosternum glabrous anterior to front coxae. *Pterothorax.* Female mesepisterna glabrous; coupling sulcus a groove slanting posteriorly and ending at a shallow elongate pit ventrally; metepisterna covered by appressed setae. *Elytra.* Surface dull copper, covered by shallow blue-green punctures of uniform depth and distribution throughout; humeral area diffuse and shiny golden green, lateral margin with a narrow diffused band of green and blue iridescence from humeral angle to apex at suture; large humeral spot and three medial spots in row one behind the other; female elytra with an inconspicuous polished area behind anterior spot; elytral apices slightly elongated and truncated, edge microserrulate; sutural spine short. *Abdomen.* All sterna covered by fine hairs with moderate, appressed setae laterally on anterior two sterna. *Legs.* Trochanters dark, nonmetallic, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic copper and blue-green. *Male genitalia.* Aedeagus long and slender, widest on apical third before tapering rapidly to a long point with a rounded tip (Naviaux, 1984b).

*Distribution.* — (Fig. 56). Sri Lanka (Hambantota and Anuradhapura districts).

*Localities.* — SRI LANKA: Anuradhapura District: Kala-oya, 8.XI.1983 (RNC, CMNH); Hambantota District: Kataragama, 1.XI.1983 (RNC, CMNH).

(*Ecology.* — Adults collected from tree leaves in moist forests (Naviaux, 1984b) and are active during the autumn monsoon in November.

***Cicindela (Ifasina) waterhousei* Horn**

*Cicindela waterhousei* Horn, 1900:206 (typesetting error).

*Type status.* Holotype, female! [by monotypy]. *Type depository.* Holotype at DEI. *Type locality.* “Ceylon” (Sri Lanka).

*Cicindela waterhousei* Horn: Horn, 1904:7 (corrected spelling).

*Cylindera (Ifasina) waterhousei* (Horn): Rivalier, 1961:142.

*Cylindera (Ifasina) waterhousei* (Horn): Naviaux, 1984b:69, fig. 31–34.



**Diagnosis.** — Distinguished by the short testaceous labrum; humeral elytral dot and three spots in a line medially; enlarged and distorted male mandibular teeth; female pronotum conical in shape; pronotum with a dorsal bulge divided in two by medial line and lacking deep transverse rugae.

**Description.** — *General habitus.* Body small (9–9.5 mm); body moderately slender; dorsum bright, head and pronotum shiny copper-red dorsally, violet, blue, green and red reflections laterally; elytra dull copper-brown; contrasting blue-green punctures; three spots in a line medially; body greenish to blackish purple ventrally. *Head.* Antennal scape with one subapical seta; male mandibles with posteroventral displacement, penultimate tooth greatly enlarged and distorted; female mandibles not distorted; labrum short, testaceous; short medial tooth; eight submarginal setae; frons finely rugose medially; longitudinal rugae extending from vertex of head onto frons laterally; genae glabrous. *Prothorax.* Pronotum glabrous; distinctive dorsal bulge lacking deep transverse rugae, situated medially on disc mesad posterior transverse sulcus, divided equally by medial line; female pronotum conical, male pronotum subparallel; proepisterna purple-green, smooth, few setae ventrally; prosternum golden, glabrous anterior to front coxae. *Pterothorax.* Female mesepisternal coupling sulcus a broad posteriorly slanting groove, narrower and deeper ventrally; metepisterna golden, covered by appressed setae. *Elytra.* Surface uniformly dull copper-brown; contrasting blue-green punctures shallow on basal half, nearly impunctate on apical half; diffuse golden green humeral area on male; large, polished golden green humeral area on female; lateral margin with a narrow blue band; humeral dot and three white spots in a line slightly lateral of center on both sexes; female elytral disc with a large polished, densely punctured area medial to and behind anterior spot; elytral apex evenly rounded, microserrulate; sutural spine small. *Abdomen.* Sterna covered by fine hairs and decumbent setae laterally on first few sterna. *Legs.* Trochanters reddish, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic green and coppery. *Male genitalia.* Aedeagus long and slender with an elongated basal portion and slightly expanded apical portion equal in length; apex blunt, tip slightly bent (Naviaux, 1984b).

**Distribution.** — (Fig. 56). Sri Lanka (Ratnapura District).

**Localities.** — SRI LANKA: Ratnapura District: Labugama, 16.VIII.1979 (RNC, CMNH); Karawanella, 17.VIII.1979 (RNC, CMNH).

**Ecology.** — Adults have been collected on vegetation and wet rocks along watercourses within dark, moist forests (Naviaux, 1984b). Adults are active during August before the autumnal monsoon.

### *Cicindela (Ifasina) willeyi* Horn

*Cicindela willeyi* Horn, 1904:36, pl. 7, fig. 4.

**Type status.** Lectotype, female [here designated]. **Type labels.** "Ceylon., 92-59" [typeset separated by a yellow line]; "Britisch. Mus." [typeset]; "Type!, Dr. W Horn" [typeset within thin black border]; "Willeyi m." [handscript]; "Syntypus" [typeset red label]; "DEI, EBERSWALDE" [typeset]; "LECTOTYPE, Cicindela, willeyi W. Horn, by R.E. Acciavatti, '84" [typed and handprinted red label]. [Lectotype is 9.5 mm; missing left middle leg.] Paralectotype, female! [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. **Type depository.** Lectotype and paralectotype at DEI. **Type locality.** "Central Province" (Sri Lanka).

*Cylindera (Ifasina) willeyi* (Horn): Rivalier, 1961:142.

**Diagnosis.** — Distinguished by the short testaceous labrum; elytral humeral dot and three spots in a line medially; female elytral apices much prolonged, sinuate and ending at a long sutural spine; female pronotum conical with a dorsal bulge undivided by a short medial line and deep transverse rugae posteriorly.

**Description.** — *General habitus.* Body small to medium (9.5–10.5 mm); body moderately slender; head and pronotum shiny copper-bronze dorsally, bright purple laterally; elytra dull copper-bronze; humeral dot (on some specimens missing) and three spots medially in a line; female elytral apex elongated, large purple tinged spine; female pronotum conical; body ventrally golden on thorax, purple or purplish black on abdomen. *Head.* Antennal scape with one subapical seta; labrum short testaceous; eight to ten submarginal setae; medial tooth short; frons finely rugose medially; longitudinal rugae on vertex extending onto frons at its sides; genae glabrous. *Prothorax.* Pronotum glabrous; distinctive



dorsal bulge medially on disc in front of posterior transverse sulcus; pronotal disc with numerous shallow and one deep transverse rugae on posterior bulge; proepisterna purple and smooth with only a few setae ventrally; prosternum golden and glabrous anterior to front coxae. *Pterothorax*. Female mesepisternal coupling sulcus a curved groove deepest medially; metepisterna golden, covered by appressed setae. *Elytra*. Blue-green punctures throughout surface, polished purple humeral area; disc color contrasting with purple lateral margin from humeral angle to suture, apex purple; small humeral dot (on some specimens missing) and three white spots arranged in a longitudinal row on disc; female elytra with a large, polished, densely punctured area behind and medial to anterior spot; elytral apices on female much prolonged, sinuate and ending at a long sutural spine. *Abdomen*. Sterna with fine hairs and appressed setae laterally only on first abdominal sternite; remaining sterna glabrous. *Legs*. Trochanters reddish, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic blue-green and copper. *Male genitalia*. Not examined.

*Distribution*.—(Fig. 56). Sri Lanka (Central Province districts).

*Localities*.—Other than the female syntypes! from Ceylon (Sri Lanka), we have not examined any other specimens of this species. Fowler (1912) listed the species from the Central Province of Ceylon (Sri Lanka).

*Ecology*.—The habitat is unreported for this species but adults probably dwell in moist forests like related species.

### *Cicindela (Ifasina) seriepunctata* Horn

*Cicindela seriepunctata* Horn, 1892a:80.

*Type status*. Lectotype, male [here designated]. *Type labels*. "Darj." [handscript]; "ex. coll., Dr. Richter" [typeset within thin black border]; "Type!, Dr. W Horn" [typeset within thin black border]; "LECTOTYPE, *Cicindela, seriepunctata* W. Horn, by R.E. Acciavatti, '85" [typed and handprinted red label]. [Lectotype is 7.5 mm; left antenna missing beyond fourth segment.] Paralectotype, male! [here designated] labelled [same label data as lectotype] "PARALECTOTYPE" [typed and handprinted red label]. *Type depository*. Lectotype and paralectotype at DEI. *Type locality*. "Darjiling" (Darjeeling, West Bengal, India).

*Cylindera (Ifasina) seriepunctata* (Horn): Rivalier, 1961:142.

*Cylindera (Ifasina) seriepunctata* (Horn): Naviaux, 1985:72, fig. 22, 57, 89.

*Cicindela (Cylindera) seriepunctata* Horn: Acciavatti, 1987:377.

*Diagnosis*.—Distinguished by the short labrum, testaceous on middle and metallic blue-green laterally; elytra lacking a humeral dot but with three spots in a line medially; elytral disc with moderately deep blue punctures.

*Description*.—*General habitus*. Body very small to small (7.5–8.5 mm); head and pronotum shiny greenish bronze to bronze dorsally, metallic green laterally; elytra dull greenish bronze to bronze on disc with three spots in a medial row, shiny blue-green along entire lateral margin; body metallic blue-green ventrally. *Head*. Labrum short, one medial tooth; six to eight submarginal setae; medial half of labrum testaceous, each lateral quarter metallic blue-green; medial carina absent; antennal scape with one subapical seta; frons finely rugose, rugae slightly arcuate medially, numerous longitudinal rugae laterally extending onto vertex adjacent to eyes; 9 to 11 mostly complete, large broadly concave rugae between each eye and vertex midline; rugae on vertex small and irregular medially; slightly bulging eyes; genae glabrous. *Prothorax*. Pronotum nearly quadrate in dorsal aspect, only slightly wider and rounded laterally; pronotum with multiple rows of large setigerous punctures laterally, long appressed setae extending toward center; transverse sulci of pronotum shallow, not contrasting in color with remainder of surface; anterior reflexed margin of pronotum shallowly and transversely rugose; rugae extending onto anterior sulci on most specimens, extending onto disc on a few specimens; rugae on disc coarse, irregular, obliterating medial line; proepisterna copper to green, almost covered by sparse setae originating from large setigerous punctures; prosternum glabrous. *Pterothorax*. Female mesepisterna glabrous except for a few sparse setae ventrally; coupling sulcus a moderately deep medial pit along posterior margin; pterothorax nearly covered by appressed setae except ventrally. *Elytra*. Surface covered by shallow, blue-green punctures contrasting with disc the dull bronze color of which may dominate or be restricted to a small area around maculae which comprise three nearly circular spots lying in a row, one on each third of the elytra, basal spot medially situated whereas apical spot is near lateral margin; apices microserrulate, cojointly rounded; sutural

spine small. *Abdomen*. Setae on sterna appressed laterally, fine hairs and scattered long erect setae medially. *Legs*. Trochanters dark blackish purple, one subapical seta on each front and middle segment; femora metallic copper-green, sparsely setose; tibiae and tarsomeres metallic purple. *Male genitalia*. Aedeagus moderately slender, acute apex ending in a small, rounded knob at distal end of genital opening.

*Distribution*.—(Fig. 57). Northeast India (West Bengal, Sikkim), Nepal and Bhutan.

*Localities*.—INDIA: Sikkim (DEI); Gopaldhara, British Sikkim (DEI); West Bengal: Golpardhara, Darjeeling, 1060 to 1450 m, 5.V.1955 (NMNH); Darjeeling (DEI); Darjeeling District, Singla, 460 m, V.1913 (DEI, MCZC); Darjeeling District, Kalimpong, 19–24.V.1930 (DEI); Darjeeling District, 3 km N Runypo, 360 m, 7.V.1973 (ZSI); 15 km N Siliguri, 3.VI.1985, 250 m, forest path (DLPC). NEPAL: Dhading District: West Samari Banjyang/Topal Kholo, 1000 to 2000 m, 23.VII.1983, cultivated land (SMFM); 51 km W Kathmandu, 26.V.1986, sandy river bank (DLPC, CMNH); 15 km S Sauraha, 28.V.1986, gravel river beach (DLPC).

*Ecology*.—Adults are found occasionally in open forests and on agricultural land, but more commonly along the sandy and gravelly margins of mountain streams. Naviaux (1985) reported this species from small watercourses in the eastern Himalaya valleys of Nepal.

### *Cicindela (Ifasina) melitops*, new species

*Diagnosis*.—Distinguished by the entirely tawny labrum; large bulging eyes; impunctate elytral surface sculpturing; three nearly circular elytral spots in a medial row.

*Description*.—*General habitus*. (Fig. 30). Body small (8 mm); head and pronotum shiny greenish bronze to bronze dorsally, metallic green laterally; elytra dorsally dull greenish bronze to bronze, disc nearly impunctate, three circular spots in a medial row, broad and diffuse shiny blue-green laterally; body blue-green ventrally. *Head*. Labrum short, tawny; nine submarginal setae; one short medial tooth; medial carina absent; antennal scape with one subapical seta; numerous, slightly raised longitudinal rugae on frons converging medially, laterally extending onto vertex adjacent to eyes; 9 to 11 mostly complete, large rugae between each eye and vertex midline; rugae smaller and irregular medially; genae glabrous; vertex of head deeply excavated between large, prominent eyes. *Prothorax*. Pronotum quadrate in dorsal aspect, slightly wider and rounded laterally; multiple rows of large setigerous punctures and short, appressed setae laterally on pronotum; transverse sulci of pronotum shallow, contrasting in color with remainder of surface; anterior reflexed pronotal margin with shallow transverse rugae extending only into anterior sulcus on most specimens, but onto disc on a few specimens; rugae on disc coarse, their pattern irregular, center line nearly obliterated at middle; proepisterna purple and blue-green; small sparse setigerous punctures over ventral two-thirds, dorsal third glabrous, surface wavy; prosternum glabrous. *Pterothorax*. Male mesepisterna slightly wrinkled, glabrous except for a few sparse setae ventrally; meso-, and metathorax nearly covered by appressed setae. *Elytra*. Surface dull greenish bronze to bronze, disc nearly impunctate with only shallow, noncontrasting punctures basally; three nearly circular spots aligned in a medial row, basal spot medially situated, apical spot near lateral margin, humeral angle without a macula; elytral apices microsculptulate and cojointly rounded. *Abdomen*. Sterna with appressed setae laterally and with fine hairs medially. *Legs*. Trochanters nonmetallic pale brown, one subapical seta on each front and middle segment; femora and tibiae metallic copper-green, sparsely setose; tarsomeres metallic purple. *Male genitalia*. Aedeagus moderately slender, width gradually increased on basal half and nearly uniform on apical half, distal end abruptly tapering and truncated; large rounded knob at apex slightly displaced to the right side in left lateral aspect; short wide apical orifice; parameres extending to nearly two-thirds of entire length.

*Body size*.—*Holotype*. Body length 8.2 mm, elytral width 2.7 mm.

*Type locality*.—Bhairabkundi, Kameng Frontier Division, Arunachal Pradesh, India.

*Type specimens*.—Holotype, male labelled "India: Assam, Bhairabkundi, 700 ft, 20.V.1961." The holotype probably originated from Bhairabkundi, Kameng Frontier Division, western Arunachal Pradesh, India.

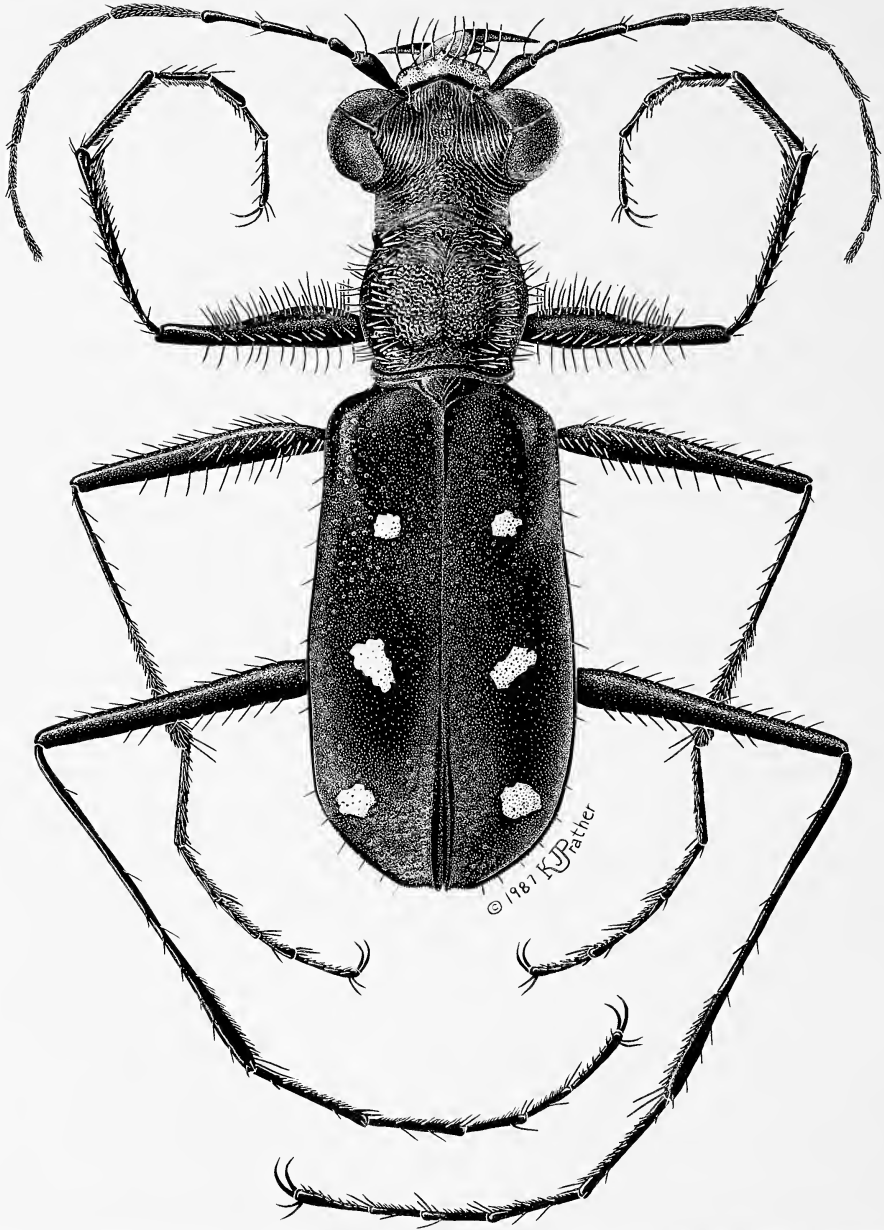


Fig. 30.—*Cicindela (Ifasina) melitops*, new species, male holotype from Bhairabkundi, Kameng Frontier Division, Arunachal Pradesh, India. (Body size, 8.2 mm.)

*Type depository.*—Holotype at CMNH.

*Distribution.*—(Fig. 57). Known only from the type locality of Bhairabkundi, Kameng Frontier Division, Arunachal Pradesh, India.

*Ecology.*—The habitat is unreported but adults most likely are associated with stream margins similar to the closely related *Cicindela seriepunctata*.

*Etymology.*—This feminine singular species name is derived from the Greek *melit-* (honey) and *-ops* (face) with respect to the completely pale, tawny labrum.

*Remarks.*—This species is closely related to *Cicindela seriepunctata*, but possesses a completely tawny labrum, larger bulging eyes and impunctate elytral sculpturing.

### *Cicindela (Ifasina) spinolai* Gestro

*Cicindela spinolae* Gestro, 1889:85.

*Type status.* Lectotype, male [here designated]. *Type labels.* "Teinzo, Birmania, Fea, Maggio, 1886" [typeset within thin black border]; "spinolae Gestro" [handscript]; "PARATYPUS" [typeset pink label]; "Museo Civico, di Genova" [typeset]; "LECTOTYPE, *Cicindela, spinolae* Gestro, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 8 mm; both antennae repaired with glue.] Paralectotypes, two males!, one female! at MCSNG from localities mentioned by Gestro, and two males! at DEI, each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository.* Lectotype and three paralectotypes at MCSNG; two paralectotypes at DEI. *Type locality.* "Teinzo, Bhamo" (Kachin State, Burma) and "Meetan" (Kyeikdon, Karen State, Burma).

*Cicindela spinolae* Gestro: Fowler, 1912:346, fig. 153.

*Cicindela spinolai* Gestro: Horn, 1915:292 (emendation).

*Cylindera (Ifasina) spinolai* (Gestro): Rivalier, 1961:142.

*Cylindera (Ifasina) spinolai* (Gestro): Naviaux, 1985:67, fig. 18, 53, 85.

*Nomenclatural note.*—Because Gestro honored Mr. Spinola with this species name, the masculine singular emendation by Horn (1915) is justified.

*Diagnosis.*—Distinguished by the completely shiny brownish black labrum (slightly copper tinged on some specimens); large humeral elytral lunule and middle band each divided in two, single apical spot at lateral margin; small scattered setigerous punctures in one or two irregular rows submarginally near lateral pronotal margin.

*Description.*—*General habitus.* Body small (7–8 mm); body form slender; head and pronotum bright copper on disc, blue-green laterally and in depressions, dark brown almost melanic on a few specimens; elytra dull brownish, standard but fragmented pattern of small, circular and irregularly shaped maculae; body metallic blue-green ventrally. *Head.* Antennal scape with one subapical seta; labrum completely shiny brownish black nonmetallic on most specimens, slight copper reflections on some others; 13 to 15 mostly complete rugae between each eye and vertex midline; frons, vertex and genae glabrous. *Prothorax.* Pronotal surface with fine and irregular rugae forming fine ridges on anterior reflexed margin and at middle across medial line where blue-green color contrasts with copper color of disc; lateral margins of pronotum with sparse, appressed setae originating from small, widely spaced setigerous punctures arranged in one or two irregular rows submarginally and extending onto anterior and posterior reflexed margins; proepisterna dorsally with many sparse setae which become more numerous on ventral half; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a deep groove along posterior margin, nearly glabrous except for a few setae near posteroventral margin. *Elytra.* Disc dull brownish with shiny green suture; narrow blue lateral edge touching middle band, remainder of lateral margin diffuse metallic green; surface with moderately deep punctures basally becoming shallow on apical third (some specimens with contrasting, shallow iridescent depressions near apex), nearly impunctate around medial portion of middle band; maculae representing extremities of humeral lunule as circular spots, a transverse middle band divided into an irregular, triangular lateral spot and an oval medial spot (on some specimens these two spots narrowly joined by a thin, posteriorly slanting line), a round apical spot as the basal remnant of the apical lunule; elytral apex microsculptate. *Abdomen.* All sterna laterally on most specimens covered with white appressed setae, most abundant on first sternum and on some specimens confined to posterior margin of remaining sterna, medially covered by numerous, fine hairs and two long setae near each posterior margin of third to fifth sterna. *Legs.* Trochanters nonmetallic testaceous, one subapical seta on each front segment; middle trochanters on most specimens without a primary seta originating subapically from a distinct fovea, some specimens have a subapical seta on one of the middle trochanters, others have setae on both of them; femora metallic copper-green; tibiae and tarsomeres metallic purple. *Male genitalia.* Aedeagus long and slender, nearly of uniform width along most of its length before tapering gradually to a rounded point displaced to the right side in left lateral aspect (Naviaux, 1985).

*Geographic variation.*—*Cicindela spinolai* adults from populations throughout its distribution exhibit some variation in the number of trochanters with subapical setae. From our observations, specimens with a subapical seta on all four anterior trochanters occur more often in the northern part of the species distribution, whereas specimens that lack primary setae on the middle trochanters occur most frequently in the southern part of its range. Study of this intraspecific variation requires large samples from many populations and is beyond the scope of this review.

Uniformly dull brownish nearly melanic specimens! at DEI collected from Kalimpong, Darjeeling District, West Bengal, India.

*Distribution.*—(Fig. 57). Eastern Nepal, northeastern India (Meghalaya, Arunachal Pradesh, Assam, West Bengal, Orissa, Bihar) and Bangladesh southeastward into Burma.

*Localities.*—NEPAL: 12 km E Kankarvitta, 150 m, 5.V.1984 (RNC, CMNH). INDIA: Assam: 8 km W Kaziranga, 130 to 200 m, 2.V.1985 (DLPC); Doom Dooma, 29.V.1943 (CMNH); 78 km W Jorhat, 100 m, 3.V.1985 (DLPC, CMNH); 16 km W Jagi Road, 28.IV.1985 (DLPC); Margherita, IV,V.1889 (MCZC); Tirap Frontier Division, Patkai Mountains (BMNH); West Bengal: Kalimpong, Darjeeling District, 19–24.V.1930 (DEI); Singla, Darjeeling District, 460 m, V.1913 (DEI); Gopaldhara, Darjeeling, 11.VI.1919 (BMNH); 15 km N Siliguri, 250 m, 3.VI.1985 (DLPC); Meghalaya: 34 km N Shillong, 700 m, 6.V.1985 (DLPC, CMNH); Nongpoh Forest, 25–28.IV.1980 (CMNH); Bihar: 65 km W Ranchi, 23.VI.1986, scrub forest (DLPC); Orissa: Simlipal National Park, 24, 25.VI.1986, forest path (DLPC, CMNH). BURMA: Shan State: Momeit, 615 m (DEI); Haute Birmanie, Etat de Momeit, 600 m, 1890 (BMNH); Goktiak, VI.10 (BMNH); Sagaing State: Upper Burma, Ruby Mines, 1540 to 2150 m (DEI); Kachin State: Bhamo, Upper Burma, IV.1916 (BMNH); Funkaung Road, Sadon-Myitkyina, 7.VIII.1934 (BMNH); Sadon, 1200 m, 28.VI–5.VII (BMNH); Chin State: North Chin Hills (BMNH).

*Ecology.*—Adults most frequently occur on the floor of moist forests, occasionally in scrub forest and have been collected from April to August. Fowler (1912) reported this species within deep jungle forests. Naviaux (1985) found large numbers of adults along forest trails, sometimes flying to land on the leafy bases of shrubs.

*Remarks.*—The concepts previous authors held about *Cicindela spinolai* and *C. subtile signata* are incorrect; both are separate species exhibiting differences for the female coupling sulcus, pronotal setal patterns, shape of the elytral middle band, and elytral surface sculpturing.

### *Cicindela (Ifasina) paucipilina*, new species

*Diagnosis.*—Distinguished by the small body size; entirely pale brown labrum; sparse lateral setae on the pronotum and abdominal sterna; narrow poorly defined purple lateral elytral margin.

*Description.*—*General habitus.* (Fig. 31). Body very small (6–8 mm); body form slender; head with narrow copper area at middle, broadly blue-green and purple, pronotum shiny golden copper on disc, broadly blue-green laterally and purple in depressions; elytra dull brownish on disc, laterally with a diffuse copper-green area mesad of a narrow purple band extending along the lateral margin from humeral angle to outer apical angle (on some specimens extreme apical edge purple); maculae representing extremities of humeral lunule, a slightly oblique or transverse middle band enlarged at margin and extending onto disc, apical lunule long, anterior apical spot touching margin; body blue-green and purple ventrally. *Head.* Labrum short, nonmetallic entirely pale brown, six to eight submarginal setae; two broadly rounded bulges on either side of one short medial labral tooth; frons with fine and irregular rugae at middle becoming coarser and longitudinal laterally and extending onto vertex; 13 to 17 mostly complete large rugae between each eye and vertex midline, rugae smaller medially; surface entirely glabrous. *Prothorax.* Pronotal surface finely and irregularly rugose, moderate rugae on disc more defined, aligned parallel and meeting along a medial line, surface smoother

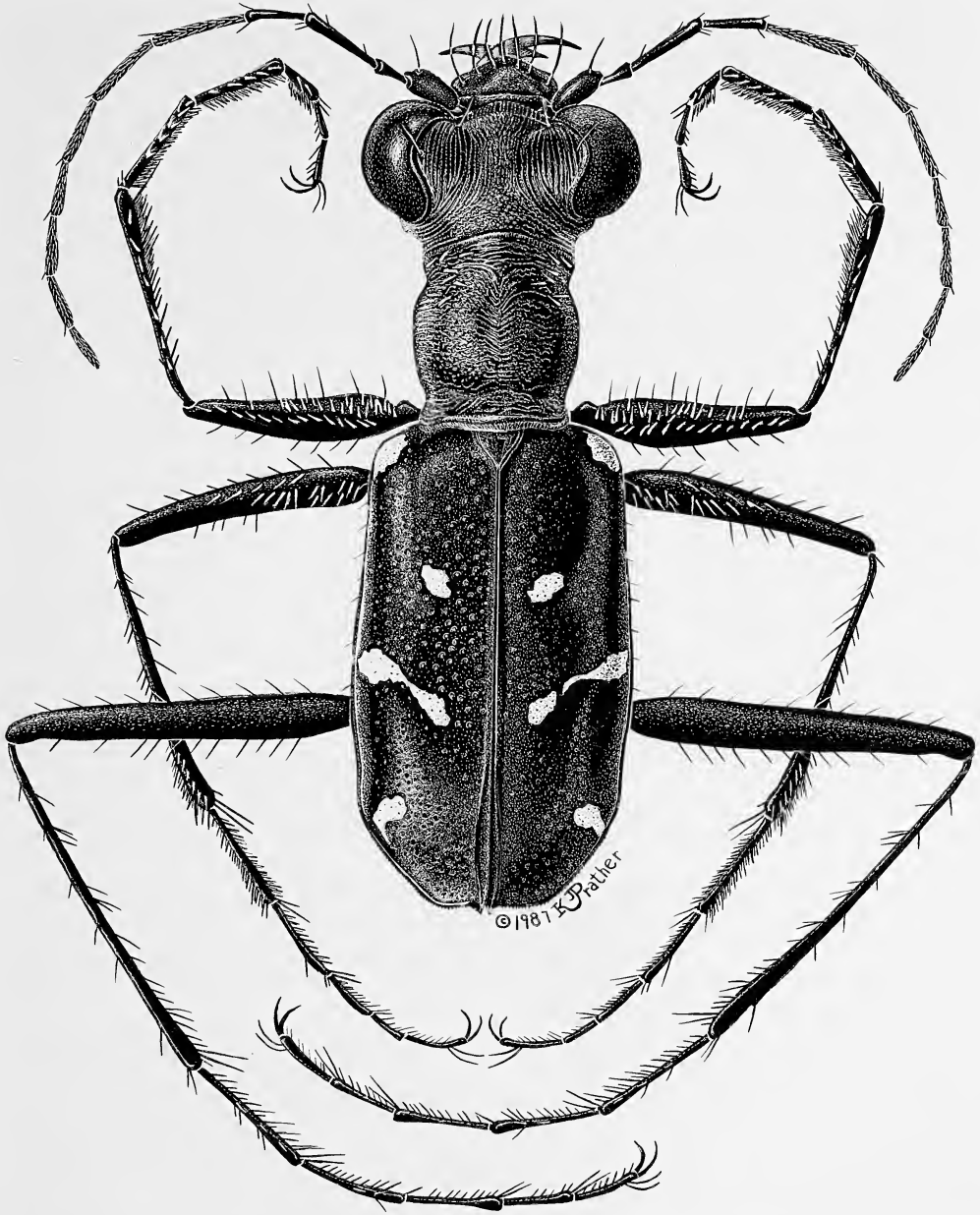


Fig. 31.—*Cicindela (Ifasina) paucipilina*, new species, male holotype from Rangoon, Burma. (Body size, 6.4 mm.)

laterally; shallowly impressed rugae form fine, transverse ridges on anterior reflexed margin where broad purple and narrow blue-green colors contrast with golden-copper and copper-green colors of disc; lateral pronotal margins of most specimens with sparse, appressed setae (some specimens entirely glabrous) originating from small widely spaced foveae mostly on anterior half and extending on anterior reflexed margin, setae on most specimens much sparser to nonexistent on posterior half; proepisterna dorsally glabrous with many parallel wrinkles, ventrally with sparse setae along anteroventral margins;



prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a posteroventrally slanting groove along posterior margin, forming a deeper depression ventrally; mesepisterna glabrous except for a few setae near posteroventral margin. *Elytra*. Disc dull brownish; broad diffuse copper-green lateral margin extending onto disc as far as posterior end of humeral spot; narrow purple band extending along lateral margin from humeral angle to outer apical angle; on some specimens extreme apical edge purple; suture dull brown; surface moderately granulate-punctate with small, noncontrasting punctures, denser and deeper basally than apically; maculae are extremities of humeral lunule; a complete slightly oblique (on some specimens more transverse) middle band enlarged at margin and extending as a narrow or slightly enlarged macula onto disc; apical lunule reduced to a long spot touching margin at anterior apical angle; elytral apex microserulate; apical margins slightly truncated; sutural spine minute. *Abdomen*. All sterna covered by abundant fine semierect hairs, only first sternum laterally with white appressed setae. *Legs*. Trochanters nonmetallic testaceous, one subapical seta on each front segment, middle trochanters lacking a subapical seta originating from a distinct fovea; femora metallic copper-green; tibiae and tarsomeres metallic purple. *Male genitalia*. Aedeagus moderately slender, widest at middle third and tapering gradually on apical third to an acute apical tip, slightly displaced to the right side in left lateral aspect.

*Body size*.—*Holotype*. Body length 6.4 mm, elytral width 2.2 mm. *Allotype*. Body length 7.5 mm, elytral width 2.6 mm.

*Type locality*.—Rangoon, Burma.

*Type specimens*.—*Holotype*, male labelled “Rangoon V.10, H.L. Andrewes” [handprinted], “Coll. DEI, Eberswalde” [typewritten]. *Allotype*, female and two female paratypes labelled same as holotype. One female paratype labelled “Rangoon, 29.5.98, Bingham Coll.” [handscript on large folded label]. Six paratypes (one male, five females) labelled either “Pegu” [handscript], or “Pegu” [typeset], or “Pegu, Waagen” [handscript]. Two male paratypes labelled “Tharawaddy., Burmah., (Corbett).” [handscript]. Three male paratypes labelled “Carin Cheba, 900–1100 m, L. Fea V–XII.88” [typeset for all but date which is handprinted within a thin black border]. One paratype labelled “Tenasserim, Meetan, Fea. Apr. 1887” [typeset within a thin black border], “SYNTYPUS, Cicindela, spinolae, Gestro 1889” [typeset and handprinted pink label], “PARALECTOTYPE, Cicindela, spinolae Gestro, by R.E. Acciavatti, '84” [typed and handprinted red label].

*Type depository*.—*Holotype*, allotype and 5 paratypes deposited at DEI; 4 paratypes each to BMNH and CMNH; 2 paratypes to MSNG.

*Distribution*.—(Fig. 55). India (Assam), Bangladesh and Burma. In addition to the type series, specimens! collected from: India: Assam: North Cachar District, Nemotha (BMNH); Bangladesh: Sylhet (BMNH).

*Ecology*.—Habitat details for this species are unreported but presumably adults occur on the floor of moist forests at low to middle elevations. The most specific collection data indicates adults occur during April and May.

*Etymology*.—This feminine singular species name is derived by combining the Latin *pauc-* (few), *pil-* (hairy) and *-ina* (likeness) with reference to the sparse lateral setae of the pronotum and abdominal sterna.

*Remarks*.—This species is closely related to *Cicindela spinolai* from which it can be readily separated by its smaller body size, entirely pale brown labrum compared with a completely shiny brownish labrum of *C. spinolai*, and sparse lateral setae of the pronotum and abdominal sterna compared to more abundant setae for *C. spinolai*.

### *Cicindela (Ifasina) limitisca*, new species

*Diagnosis*.—Distinguished by the dark brownish black, nonmetallic labrum with two pale yellow areas; lateral elytral margin purple and very wide, abruptly contrasting with copper-green lateral band and dull brownish disc.



*Description.*—*General habitus.* (Fig. 32). Body small (8–10 mm); body form slender; head with narrow copper area at middle, broadly blue-green and purple; pronotum shiny golden copper on disc, broadly blue-green laterally and purple in depressions; elytra dull brownish on disc, laterally with very wide copper-green band mesad of broad and discrete purple band extending along the entire margin; maculae as extremities of humeral lunule, middle band nearly transverse enlarged at margin and on disc, anterior apical spot small, circular; suture copper-green; body blue-green and purple ventrally. *Head.* Labrum short, nonmetallic; a testaceous area on each side of a dark, brownish black middle with all margins darkened; labrum on some specimens (more often males than females) mostly pale testaceous with darker brown center; eight to ten submarginal setae and one short medial tooth; frons with fine and irregular rugae; 13 to 15 mostly complete rugae between each eye and vertex midline, rugae near eye much closer together than those medially; surface entirely glabrous. *Prothorax.* Pronotal surface moderately alutaceous on disc where cracks become parallel and meet along a medial line, surface smoother laterally; shallowly impressed rugae form fine ridges on anterior reflexed margin; broad purple and narrow blue-green colors on margin contrast with golden copper color of disc; lateral margins of pronotum with sparse, appressed setae originating from small, widely spaced foveae arranged in one or two irregular, submarginal rows extending onto anterior and posterior reflexed margins; proepisterna dorsally glabrous, ventrally with sparse setae along anteroventral margins; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a posteroventrally slanting groove along posterior margin, forming a deeper depression ventrally; mesepisterna glabrous except for a few setae near posteroventral margin. *Elytra.* Elytral disc dull brownish, wide copper-green band along lateral elytral margin extending mesad to apical end of humeral spot, and mesad of a very broad discrete purple band extending from outer humeral angle to suture and encompassing much of apical spot anteriorly; suture diffuse copper-green; surface moderately granulate-punctate with small, noncontrasting punctures, basally denser and deeper than apically; punctures shallow, sparse noncontrasting around medial portion of middle band; apical surface on most specimens with minute shallow iridescent depressions; maculae are extremities of a humeral lunule as circular spots; middle band nearly transverse divided into an irregular, triangular lateral spot and an oval medial spot joined by a narrow band; round apical spot as the basal remnant of the apical lunule; elytral apex microserulate, margins slightly truncate; sutural spine minute. *Abdomen.* All sterna covered by abundant, fine semierect hairs, but only first sternum laterally with white appressed setae. *Legs.* Trochanters testaceous nonmetallic, one subapical seta on each front segment, middle trochanters lacking a primary seta originating subapically from a distinct fovea; femora metallic copper-green; tibiae and tarsomeres metallic purple. *Male genitalia.* Not examined.

*Body size.*—*Holotype.* Body length 9.8 mm, elytral width 3.1 mm.

*Type locality.*—Kurseong, Darjeeling District, West Bengal, India.

*Type specimens.*—Holotype, female labelled “Kurseong” [typewritten]; one female paratype labelled “Ind. Mus”. [typeset, underlined], “Pashok, alt. 1000 ft., Darjiling (sic) dist., E. Himalayas, 19” [typeset] and “H.C. Hartless” [typeset sideways]; 1 female paratype labelled “Gielle Khola, Tista Valley, Br. Sikkim, 600 ft, 12.VI.19, H. Stevens” [typeset]; 1 female, 3 male paratypes labelled “N. INDIA: Sukna, 55 km s. of Darjeeling, V.1966” [typeset and handprinted], “J. & M. Sedlacek, Collectors, BISHOP MUSEUM” [typeset].

*Type depository.*—Holotype at CMNH; 4 paratypes to BPBM; 1 paratype each to DEI and BMNH.

*Distribution.*—(Fig. 57). India (West Bengal and Sikkim).

*Ecology.*—Habitat unreported but possibly moist forests like related species. Adults have been collected at low elevations of 200 to 300 m during June.

*Etymology.*—This feminine singular species name is derived from the Latin *limit* (boundary) and *-isca* (diminutive suffix) with reference to the very wide and well defined purple lateral elytral margin.

*Remarks.*—*Cicindela (Ifasina) limitisca* is closely related to *Cicindela (Ifasina) spinolai*. The labrum of *Cicindela limitisca* is dark nonmetallic brownish black to pale brown at middle with two pale yellow lateral areas in comparison with the completely darkened, shiny blackish brown nonmetallic labrum of *C. spinolai*. In addition, *Cicindela limitisca* has a wide, well defined purple lateral elytral margin whereas *C. spinolai* has a narrow, diffuse metallic lateral margin.

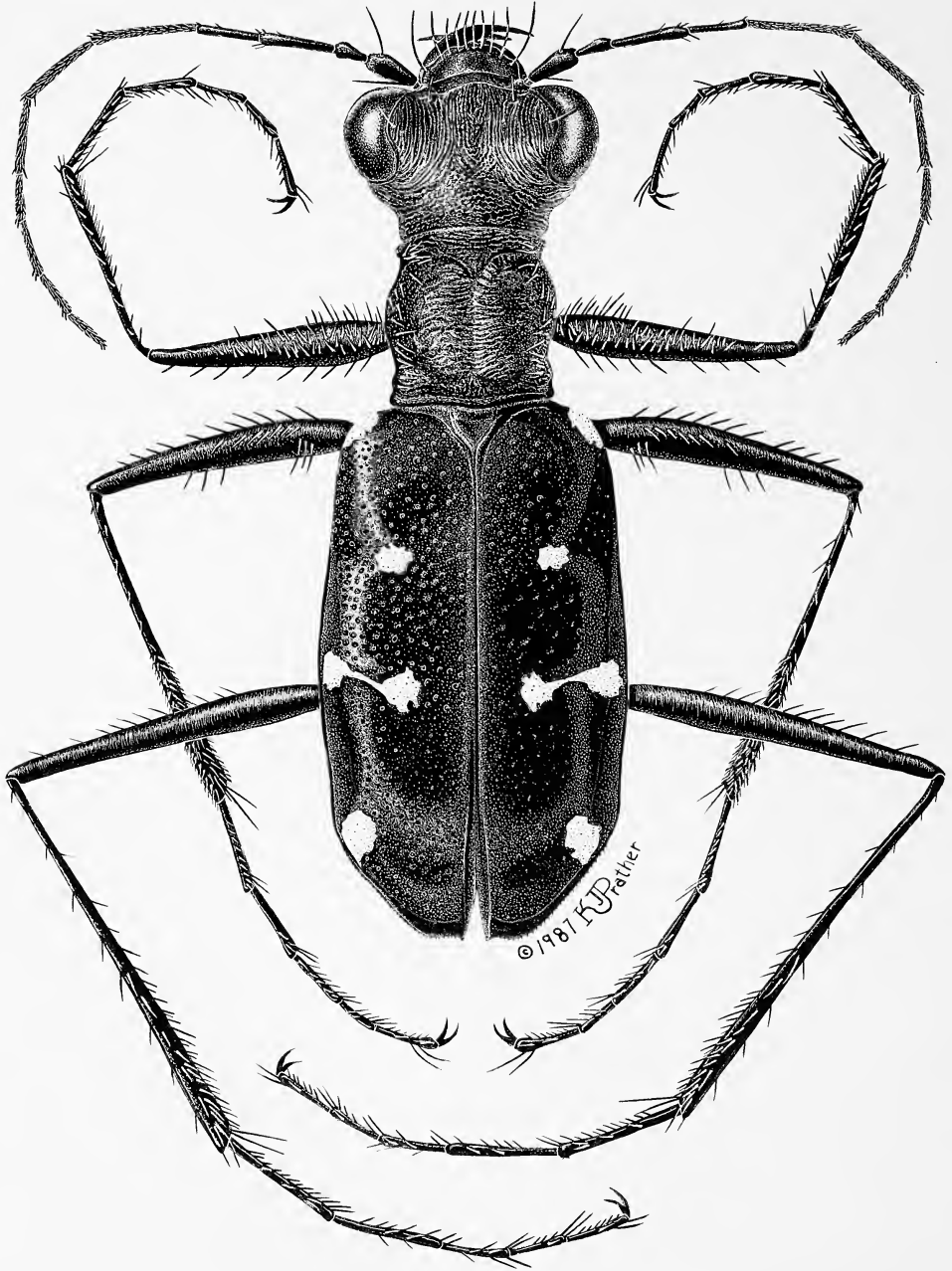


Fig. 32.—*Cicindela (Ifasina) limitisca*, new species, female holotype from Kurseong, Darjeeling District, West Bengal, India. (Body size, 9.8 mm.)

***Cicindela (Ifasina) subtile signata* Mandl, new rank**

*Cicindela decempunctata subtile signata* Mandl, 1970:211.

*Type status.* Holotype, male! [erroneously stated as a female in its original description]. *Type labels.* "6" [typed numeral]; "NEPAL, Bulchoki, ca. 2000, m, am Bach SO., Kathmandu, Löffler" [hand-printed]; "Holo-Typus, *Cicindela decem-, punctata* ssp., *subtile signata* m., 1961, det. Dr. K. Mandl" [all lines handprinted except 'Typus' and all of last which are typeset on label with one side colored orange]. [A female! sent from ZSBS as an apparent paratype is not treated as a paratype because its label data differ from that published with the description.] *Type depository.* Holotype at ZSBS. *Type locality.* "Nepal, Bulchoki, ca. 2000 m, am Bach" (southeast of Kathmandu, Nepal).

*Cylindera (Ifasina) spinolai albiovittata* Naviaux, 1985:70, fig. 19, 54, 86, 87.

*Type status.* Holotype, male [unexamined; concept based on two paratypes! at BMNH]. *Type depository.* Holotype at MNHNP. *Type locality.* "7 km ouest de Sauraha, Népal central" (Chitwan District, Nepal).

*Cicindela (Cylindera) decempunctata subtile signata* Mandl: Acciavatti, 1987:377.

*Cylindera (Ifasina) spinolai subtile signata* (Mandl): Naviaux, 1987:78.

**Diagnosis.**—Distinguished by the completely dark brownish black labrum; humeral elytral lunule divided into two dots; middle band complete, narrow and transverse; apical lunule reduced to anterior spot; large setigerous punctures densely arranged in regular rows at extreme lateral pronotal margin.

**Description.**—*General habitus.* Body very small to small (7–8 mm); head copper with narrow, blue-green reflections laterally; pronotum copper dorsally, broad blue-green reflections laterally and throughout anterior and posterior reflexed margins; elytra dull, dark bronze on disc, shiny blue and green on lateral and sutural margins; maculae reduced to small dots with only the middle band narrow and complete; body metallic purplish green ventrally. *Head.* Antennal scape with one subapical seta; labrum nonmetallic dark brown to brownish black; 13 to 15 mostly complete rugae between each eye and vertex midline; frons, vertex and genae glabrous. *Prothorax.* Extreme lateral margins of pronotum from anterior to posterior edge with two to three regular rows of dense appressed setae originating from large foveae (on some specimens foveae nearly touch one another); proepisterna sparsely setose on ventral half, on some specimens glabrous on dorsal half, on other specimens one or two setae on dorsal half; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a small deep medial pit; mesepisterna glabrous dorsally, numerous appressed setae posteroventrally to pit. *Elytra.* Surface dull, dark bronze on disc with a diffuse shiny copper humeral area merging with a narrow blue-green lateral margin extending medially beyond lateral edge of middle band; suture shiny metallic blue-green; elytral punctures discrete throughout, especially adjacent to maculae; punctures deepest on basal third, moderately deep on middle third, shallow on apical third; maculae form a humeral dot, a medial spot on basal third, a narrow complete transverse middle band slightly curved toward apex (short, narrow lateral expansion on a few specimens), lateral spot on apical quarter; microserulations small. *Abdomen.* All sterna except first covered by numerous fine hairs and two long hairs medially, white appressed setae laterally. *Legs.* Trochanters testaceous, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic copper-green. *Male genitalia.* Aedeagus broad, widest on apical third before tapering abruptly to a broadly rounded apical point displaced abruptly to the right side in left lateral aspect (Naviaux, 1985).

**Distribution.**—(Fig. 57). Nepal and northern India (Punjab, Uttar Pradesh, Himachal Pradesh, West Bengal). Also occurs in Burma.

**Localities.**—NEPAL: Gajuritar, 520 m, 20.V.1984 (RNC, CMNH); Kathmandu, 27.V.1955 (CMNH); Kathmandu, Balaju, 1385 m, 10.VI.1967 (CNCO); Kathmandu Valley, Godavari, V.1972 (CMNH); 54 km W Kathmandu, 26.V.1986, sandy river bed (DLPC); Gandaki NW Pokhara, Yamdi Khola, Suikhet, 1000 m, 7.VI.1986 (JPC, CMNH); Dhawalagiri, Myagdi District, Kali Gandaki Khola, Taiopani, 1100 m, 27, 28.VI.1986 (JPC, CMNH); 2 mi SE Sikha, 2150 to 2460 m, 23.V.1954 (BMNH); Chitwan District: 15 km S Sauraha, 28.V.1986, forest path (BMNH). INDIA: Uttar Pradesh: Dehra Dun, 26.VI.1912 (DEI); 15 km N Dehra Dun, 10.VII.1982 (DLPC); 20 km NW Dehra Dun, 30.VI.1983, forest path (DLPC, CMNH); Dehra Dun, Nathibarkala, Bindal River, 23.VII.1932 (CASS); Almora District, Ranikhet, 20.VI (BMNH); Naini Tal District, Haldwani (BMNH); West Almora District,

Jagthana, 1540 m, VI.1933 (BMNH); Himachal Pradesh: 10 km S Solon, 18.VII.1982, rocky creek bed (DLPC); 20 km N Kalka, 26.VI.1983, rocky river bed (DLPC); 20 km S Bilaspur, 25.VII.1982, rocky river bed (DLPC); West Bengal: Darjeeling District, Gopaldhara, 11.VI.1918, 1075 m, on path (BMNH); Darjeeling District, Gopaldhara, 5.VII.14, 1045 to 1450 m (BMNH). BURMA: Chin State: Mount Victoria, 1000 m, VII.1938 (BMNH); Shan State: Momeit (BMNH).

*Ecology*.—Adults are frequently collected on exposed rocks and boulders in mountain streams and on the floor of nearby forests during the monsoon season.

*Remarks*.—*Cicindela (Ifasina) subtile signata* bears closer affinities to *C. (Ifasina) spinolai* than to *C. (Ifasina) decempunctata* as Naviaux (1987) also concluded. Females of *Cicindela subtile signata* possess a coupling sulcus forming a medial mesepisternal pit, that of *C. spinolai* forming a deep posterior groove, and a coupling sulcus is absent on *C. decempunctata* females. Such differences would isolate these species where sympatric. *Cicindela spinolai albovittata* is identical with our concept of *C. subtile signata* (based on paratypes! of *C. spinolai albovittata* at BMNH); the two taxa were recently synonymized under *C. spinolai subtile signata* by Naviaux (1987).

*Cicindela (Ifasina) subtile signata* differs from the newly described *C. (Ifasina) limitisca* by its different type of female coupling sulcus, a completely darkened labrum, lacking the wide purple lateral elytral margins, and having an oblique rather than transverse middle band. Furthermore, *Cicindela (Ifasina) subtile signata* and another new species, *C. (Ifasina) paucipilina*, differ by body size, female coupling sulcus, labral color, and pronotal and abdominal setal patterns.

### *Cicindela (Ifasina) decempunctata* Dejean

*Cicindela decempunctata* Dejean, 1825:145.

*Type status*. Syntypic females [referenced in description; unexamined; concept based on comparing original description to a female! labelled "Birganj, Lothar (River), 140 m, 9.IX.1967" at CMNH]. *Type depository*. ?MNHN. *Type locality*. "Indes Oriental" (undoubtedly from northern India or Nepal).

*Cicindela decempunctata obscuradilatata* Horn, 1914:28, new synonymy.

*Type status*. Syntypes [description based on a male from Delhi and an unspecified number of each sex from Lahore; unexamined; concept based on its description compared to a specimen! labelled "India, Uttar Pradesh, Dehra Dun, 20–30.V.1981, 700 m, new forest" at CMNH]. *Type depository*. Unreported. *Type locality*. "Delhi" (India) and "Lahore" (Pakistan).

*Cylindera (Ifasina) decempunctata* (Dejean): Rivalier, 1961:142.

*Cylindera (Ifasina) decempunctata* (Dejean): Naviaux, 1985:73, fig. 25, 60.

*Diagnosis*.—Distinguished by the dark brown labrum having two testaceous areas on either side of middle; large humeral lunule divided in two, middle band oblique and narrowly complete, apical lunule complete, encompassing entire apical margin and touching suture; small sparse setigerous punctures in one or two regular rows laterally on pronotum.

*Description*.—*General habitus*. Body small (9–10 mm); body form moderately slender; head and pronotum copper to copper-green dorsally, blue-green lateral reflections; elytra dull, dark copper-green or brown, complete but separated pattern of small maculae (on some specimens humeral lunule complete), except for complete apical lunule; body blue-green to purple ventrally. *Head*. Antennal scape with one subapical seta; labrum short, nonmetallic dark brown-black (on some specimens slightly purple tinge at extreme anterolateral margins), on most specimens two distinctive testaceous areas on either side of middle although on some individuals these are obscure, on others absent, six to eight submarginal setae and one acute medial tooth; 13 to 15 mostly complete, longitudinal rugae between each eye and vertex midline; vertex finely sculptured medially; eyes large and bulging; clypeus, frons and genae glabrous. *Prothorax*. Pronotum finely sculptured, laterally one or two nearly regular rows

of sparse, small setigerous punctures; proepisterna blue-green to purple, smooth and glabrous except for sparse setae at anterior, coxal and posterior margins; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a shallow circular pit on some specimens, on other specimens pit lengthened into short shallow groove medially; mesepisterna almost entirely glabrous, remaining pleurites and sternites covered by abundant appressed setae. *Elytra*. Surface dull, dark copper-green or brown with surface entirely covered by large, shallow, blue punctures; punctures apically wide nearly touching one another, basally deepest slightly granulate-punctate; elytral maculae varied; extremities of humeral lunule (on a few specimens complete); complete although medially constricted middle band (on some specimens enlarged portions narrowly joined, on others portions separated); complete apical lunule broadly reaching suture, on some specimens narrowly joined and dilated basal portion (on a few specimens portions separated); female elytra slightly expanded laterally at middle; epipleural groove twisted outward; apex microserulate; apical margin truncate before suture; sutural spine small. *Abdomen*. All sterna laterally with abundant, appressed setae and medially covered by fine hairs. *Legs*. Trochanters reddish, testaceous, one subapical seta on each front and middle segment; coxae and femora blue-green, tibiae and tarsomeres purple. *Male genitalia*. Aedeagus long and slender, widest at middle, tapering gradually and uniformly to an elongate point acute at apex.

*Geographic variation*.—Individuals of each sex from Haryana and Uttar Pradesh, India, Punjab, Pakistan and Nepal often have broader maculae with extremities of the humeral lunule narrowly or broadly fused; these have been named *Cicindela obscurдилatata* Horn. However, because males of this taxon have identical genitalia compared to *Cicindela decempunctata*, we consider *C. obscurдилatata* a junior synonym. This synonymy may be altered by further study of large series from throughout the range of *Cicindela decempunctata*.

*Distribution*.—(Fig. 58). Pakistan (Punjab) and northern India (Uttar Pradesh, Punjab, Haryana, Bihar, West Bengal, Assam), Nepal and Bangladesh (Dacca) eastward into Burma.

*Localities*.—INDIA: Assam: Kohara, Kaziranga, 110 m, 7, 16.X.1961 (CASS, CMNH); West Bengal: Malda, 110 m, 28.X.1961 (CASS); Uttar Pradesh: Naini Tal, 19.IX.1985, night light (DLPC); 15 km N Dehra Dun, 29.VI.1983, forest path (DLPC); Dehra Dun, 700 m, 20–30.VI.1981, new forest (JPC, CMNH); Punjab: Zirakpur, 1970 (DLPC). NEPAL: Lothar River near Birganj, 140 m, 9.IX.1967 (CNCO, CMNH); Chitwan National Park, 15 km S Sauraha, 21.V.1986, night light (DLPC).

*Ecology*.—Adults are generally found within openings in secondary forest and shrubby areas. They are attracted to lights (Naviaux, 1985).

*Remarks*.—The Burmese *Cicindela (Ifasina) modica* Gestro, 1893:354, was synonymized (Horn, 1926) with *Cicindela (Ifasina) decempunctata* Dejean, 1825. However, *Cicindela (Ifasina) modica*, new rank, is a separate species based on our study of its syntypes! at MCSNG, MNHB and DEI. By comparison with *Cicindela decempunctata*, *C. modica* adults are somewhat darker and duller without extensive blue-green reflections on the head, have a uniformly dark labrum, most specimens have smaller spots on humeral and basal areas of elytra, possess a separate basal portion of the apical lunule, and the female elytra lack any lateral expansion.

### *Cicindela (Ifasina) anelia*, new species

*Diagnosis*.—Distinguished by the glabrous or very sparsely setose pronotum; uniformly darkened labrum (a few specimens with two lateral testaceous areas); reduced maculation surrounded by darkened infuscation; small noncontrasting elytral punctures; wide lateral expansion on female elytra.

*Description*.—*General habitus*. (Fig. 33). Body small (8–10 mm); body form moderately slender; head and pronotum copper dorsally, purple to blue-green laterally; elytra dull, dark copper-brown with a pattern of small maculae often surrounded by a darkened infuscation, forming an incomplete pattern, humeral lunule represented by two spots, a complete but medially narrowed middle band,

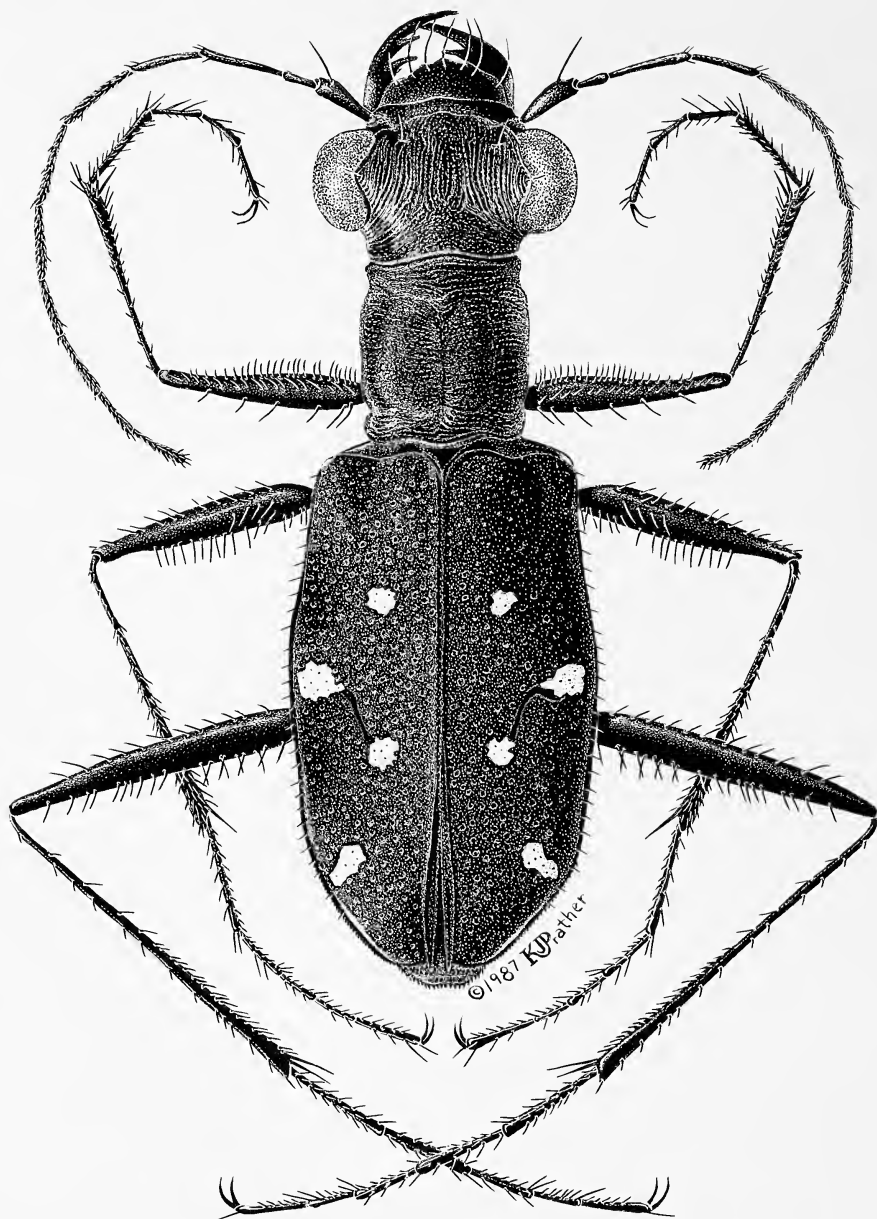


Fig. 33.—*Cicindela (Ifasina) anelia*, new species, female holotype from 54 km E Panaji, Goa, India. (Body size, 9.2 mm.)

apical lunule on a few specimens complete with a narrow lateral extension ending before reaching suture; lateral expansion on middle of female elytra; body purplish or greenish black ventrally. *Head.* Labrum short, entirely brownish black and medial carina broad on most specimens (a small, pale testaceous slightly depressed area on each side of medial carina on a few specimens); six to eight submarginal setae, one acute medial tooth; 13 to 15 slightly raised, mostly complete, longitudinal rugae between each eye and vertex midline; vertex finely sculptured medially and behind eyes; clypeus,



frons and genae glabrous. *Prothorax*. Pronotum finely sculptured, laterally glabrous or with one irregular row of appressed setae; proepisterna blue-green to purple-black, smooth and glabrous except for sparse setae at anterior, coxal and posterior margins; prosternum glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a shallow elongate pit or short groove lying posterior to middle; mesepisterna almost entirely glabrous, remaining pleura and sterna covered by abundant appressed setae. *Elytra*. Elytral surface dull, dark copper-brown entirely covered by small noncontrasting punctures; basally punctures deepest and minutely granulate-punctate; elytral maculae small and often surrounded by a darkened infuscation; maculae representing extremities of humeral lunule, middle band divided on most specimens (narrowly joined on other specimens) connected by a thin darkened line, apical lunule with apical marginal extension very narrow and on most specimens not reaching suture; female elytral epipleural groove at middle twisted at right angles to create a wide lateral expansion; apex microserulate; apical margin slightly rounded; sutural spine small. *Abdomen*. All sterna laterally with abundant, appressed setae and medially covered by fine hairs. *Legs*. Trochanters reddish testaceous, one subapical seta on each front and middle segment; coxae and femora blue-green, remaining segments purple. *Male genitalia*. Aedeagus moderately long and slender, widest at middle third, then gradually and uniformly tapering on apical third to an elongate, acute point with the apex displaced slightly to the right side in left lateral aspect.

*Body size*.—*Holotype*. Body length 9.2 mm, elytral width 3.4 mm. *Allotype*. Body length 8.4 mm, elytral width 3.0 mm.

*Type locality*.—54 km E Panaji, Goa, India.

*Type specimens*.—*Holotype*, female labelled "INDIA: Goa, 54 km E Panaji, 13.VI.1984, D.L. Pearson; forest path" [typeset]. Six female paratypes labelled with same data as holotype. Male allotype, 19 additional paratypes labelled "INDIA: Goa, 56 km E Panaji, 17.VII.1986, D.L. Pearson; forest stream edge" [typeset].

*Type depository*.—*Holotype* and 1 paratype at IARI; allotype to NMNH; 21 paratypes to DLPC; 2 paratypes to CMNH; 1 paratype to ZSI.

*Distribution*.—(Fig. 57). India (Goa, Karnataka). In addition to specimens from the type locality, this species has been collected as follows: INDIA: Karnataka: Mudigere, 17.V.1986, forest path (DLPC); Sringeri, 650 m, 8.VI.1987, forest stream edge (DLPC, CMNH); 15 km W Sirsi, 100 m, 11.VI.1987, forest path (DLPC).

*Ecology*.—Adults are restricted to lowland rainforest floor near streams.

*Etymology*.—This feminine singular species name is derived from a transliteration of the Greek *anelios* (sunless) with reference to its habitat within dark rainforest.

*Remarks*.—This new species is closely related to *Cicindela decempunctata* Dejean from which it differs by its glabrous or very sparsely setose pronotum, uniformly darkened labrum on most specimens (a few specimens with two lateral testaceous areas), reduced maculation surrounded by darkened infuscations, tendency for small noncontrasting elytral punctures, and wider lateral expansion on the female elytra. The two species also differ in their habitat preferences and distributions.

### *Cicindela (Ifasina) sikhimensis* Mandl, new rank

*Cicindela discreta sikhimensis* Mandl, 1982a:64.

*Type status*. *Holotype*, male [unexamined; concept based on a female paratype! at BMNH]. *Type depository*. *Holotype* at ZSBS. *Type locality*. "Nurbong Mahanuddi Vy., 4720–5100 ft, Darjeeling" (West Bengal, India).

*Diagnosis*.—Distinguished by the setose genae; short nonmetallic labrum; lack of humeral elytral lunule.

*Description*.—*General habitus*. Body very small (7–8 mm); head and pronotum dark bronze-green with green reflections laterally; elytra dull bronze without a humeral lunule and with the remaining



maculae reduced to small spots; body metallic yellow-green ventrally. *Head*. Labrum short and transverse, entirely nonmetallic, testaceous; seven to ten submarginal setae; anterior margin tridentate, middle tooth acute and longest, lateral teeth obtuse; rugae on frons fine irregular medially, coarser laterally; fine rugae medially on vertex; 10 to 14 moderately raised longitudinal rugae at base of eyes, much finer next to eyes; eyes extremely large and bulging; genae covered sparsely with long appressed setae. *Prothorax*. Pronotum finely rugose; glabrous on disc with multiple rows of irregular setae laterally; proepisterna completely covered by dense setigerous punctures; prosternum smooth and glabrous. *Pterothorax*. Female mesepisternal surface roughened; coupling sulcus a shallow groove medially. *Elytra*. Surface dull bronze except for slight copper-green on the suture and basal half of lateral margin; entire surface granulate-punctate, punctures deep discrete basally becoming slightly shallower apically; two spots at middle of elytra (one marginal, the other medial) and a narrow apical lunule at margin with only a slightly enlarged basal end; elytral apex microseerrulate; apical margins truncated near suture; apical spine small. *Abdomen*. Setae on sterna fine erect hairs medially merging with long, thickened appressed setae laterally. *Legs*. Trochanters nonmetallic dark brown, slightly green tinged, one subapical seta on each front and middle segment; femora metallic copper-green; tibiae and tarsomeres shiny purple. *Male genitalia*. Aedeagus small, very slender and nearly of uniform width on middle third and apical third before abruptly tapering to an acute straight point at apex.

*Distribution*.—(Fig. 58). Northeast India (Assam, West Bengal, Meghalaya, Manipur) eastward into Burma.

*Localities*.—INDIA: Assam: Doom Dooma, 1943 (DLPC); Nengba, 150 m, 25.V.1960 (CMNH); Chabua, 29.IV.1944 (CMNH); Meghalaya: Tura, Garo Hills, 310 to 460 m, VII.1917 (DLPC).

*Ecology*.—Adults occur along roads from 150 to 500 m between April and July.

*Remarks*.—*Cicindela sikhimensis* has been confused by previous authors with either the nominal form of *Cicindela discreta* Schaum, 1863:59, or its subspecies *Cicindela discreta reductula* Horn, 1915:298, both of which occur only in the eastern portions of the Oriental biogeographic region. *Cicindela sikhimensis* is morphologically distinct from either of these taxa because its females lack the deeply sculptured mesepisternal coupling sulcus, the lateral elytral expansion and the dark glossy discal spot on the basal third of the elytra, all possessed by the other two taxa.

### *Cicindela (Ifasina) kaleea* Bates

*Cicindela kaleea* Bates, 1866:340.

*Type status*. Syntype(s)? [unexamined; concept based on comparison of description with specimens! labelled "China, Taiwan, Taipei, Yanminshan, 13.VI.1984", at CMNH]. *Type depository*. ?MNHN. *Type locality*. "Formosa" (Taiwan, China).

*Cicindela kaleea kaleea* Bates: Horn, 1915:298.

*Cylindera (Ifasina) kaleea* (Bates): Rivalier, 1961:142.

*Diagnosis*.—Distinguished by the nonmetallic labrum; long narrow elytral macula at middle of lateral margin; absence of a subapical seta on middle trochanters.

*Description*.—*General habitus*. Body small (9–10 mm); head and pronotum shiny copper dorsally, metallic blue-green laterally, the blue color often broadly extends dorsally to inner angle of eyes and transverse sulci of pronotum; elytral dull brown almost black, pattern of separated spots subspecifically varied in size, shape and number; long narrow macula at middle of lateral margin on most specimens; body blue-green to purplish black ventrally. *Head*. Labrum short, one small medial tooth flanked by a rounded bulge; six to eight submarginal setae, nonmetallic; color varied from entirely dark on some specimens to mostly pale on other specimens, on a few specimens two testaceous areas medially separated by a darkened, slightly raised ridge; vertex finely rugose; 13 to 16 mostly complete rugae between each eye and vertex midline; genae on some specimens sparsely setose at ventral margin, on other specimens surface dimpled, on a few specimens setae absent. *Prothorax*. Pronotal disc finely and irregularly rugose; more conspicuous and transverse rugae at middle merging with numerous, fine transverse rugae along anterior reflexed margin; pronotum glabrous except for many appressed setae originating from moderately sized setigerous punctures arranged in several irregular rows at lateral

margin; proepisterna smooth and nearly glabrous except for sparse, scattered setae on ventral half (on some specimens a few setae dorsally); prosternum glabrous with a transversely wrinkled surface. *Pterothorax*. Female mesepisternal coupling sulcus a shallow groove medially, deeper and elongate ventrally. *Elytra*. Surface with numerous small purple punctures basally grading into purple impunctate flecks apically; maculae varied; humeral elytral lunule divided, one spot at humeral angle, one mesad on basal third; middle band with lateral expansion extending apically (on some specimens thin, on others missing) medial extension separated (on some specimens narrowly connected); apical lunule complete, basal portion expanded; apex finely microsculptate; apical margins evenly and cojointly rounded; sutural spine small. *Abdomen*. Sterna with fine hairs, laterally with longer and denser appressed setae. *Legs*. Trochanters yellow testaceous, one subapical seta on each front segment, middle segments lack subapical seta; femora metallic blue-green except for a pale, shiny bronze distal end abruptly contrasting with remainder of segment; tibiae and tarsomeres shiny purple. *Male genitalia*. Aedeagus slender, widest on middle third, tapering gradually to a blunt round point, bending slightly to the right side in left lateral aspect.

*Geographic variation*.—Variation exists throughout the range of this species in size, shape and number of elytral maculae as well as for color of the labrum and setal presence of the genae. Several subspecies have been described from China and Taiwan, none of which will be discussed here.

*Distribution*.—(Fig. 58). Northeast India (Assam). Reported from Sikkim by Heynes-Wood and Dover (1928). Found eastward into southern China and Taiwan.

*Localities*.—INDIA: Assam: Margherita, IV, V.1889 (CMNH). VIETNAM: Vin Phu Province: Tamdao, 3–11.V.1985 (JPC, CMNH); Tamdao, 27.V–2.VI.1986 (JPC, CMNH). CHINA: Taiwan: Taipei, Yanminshan, 20.VIII.1968, 13.VI.1984 (CMNH); Taipei Sungshan, 10.VI.1984 (CMNH); Taihorin, 7.VIII.1911 (CUI). Specimens! with questionable locality data exist from India, Union Territory, New Delhi (IARI).

*Ecology*.—Habitat unreported but adults probably occur in forest openings.

*Remarks*.—The varied characters observed in specimens available to us implies that this species may include several species, an implication to be tested by further study of specimens from populations throughout the range of this species and examination of the syntypes of the different described taxa.

### Subgenus *Cicindela* (*Eugrapha*) Rivalier

*Cylindera* (*Eugrapha*) Rivalier, 1950:233.

Type species.—*Cicindela trisignata* Dejean, 1822.

*Cylindera* (*Eugrapha*) Rivalier: Rivalier, 1961:143.

*Diagnosis*.—*Cicindela* (*Eugrapha*) species adults share a similarly formed male genitalic internal sac with those of *Cicindela* (*Ifasina*) because the slender flagellum coils only in the left lateral aspect, lacks sustained membranes and is accompanied by a small stiffening rib near its base. However, *Cicindela* (*Eugrapha*) adults can be separated from those of *Cicindela* (*Ifasina*) by these external morphological characters: 1) standard pattern of elytral maculae, middle band sinuate; adults of most species with the lunules separated and complete; on adults of a few species all lunules joining a continuous lateral band; 2) dense appressed or decumbent setae on adults of most species over all pleura and sterna, and extend laterally onto the pronotum but are rare, and then only sparse, on portions of the head; 3) labrum nonmetallic pale testaceous or white with small teeth and six to ten submarginal setae; 4) male genitalia with a protuberance at its apical end; 5) antennal penicillum of clubbed bristles on males of certain species.

*Included species*.—The following *Cicindela* (*Eugrapha*) species occur on the

Indian subcontinent: *C. (E.) bigemina* Klug, 1834; *C. (E.) brevis* Horn, 1905, new rank; *C. (E.) minuta* Olivier, 1790; *C. (E.) cognata* Wiedemann, 1823; *C. (E.) erudita* Wiedemann, 1823; *C. (E.) agnata* Fleutiaux, 1890; *C. (E.) ancistridia*, new species; *C. (E.) venosa* Kollar, 1836; *C. (E.) grammophora* Chaudoir, 1852; *C. (E.) singalensis* Horn, 1911; *C. (E.) sublacerata* Solsky, 1874. One species, *C. (E.) procera* Horn, 1905, new rank, may occur on the Indian subcontinent. Three other species, *C. (E.) iravaddica* Gestro, 1893, new rank, *C. (E.) biprolongata* Horn, 1924, new rank, from Burma, and *C. (E.) mutata* Fleutiaux, 1893, from Thailand, are briefly discussed in the context of closely related Indian subcontinent species with which they have been previously subspecifically ranked.

Key to adults of *Cicindela (Eugrapha)* species

1. Genae and clypeus glabrous ..... 2
  - Genae and clypeus with sparse appressed setae ..... *sublacerata* Solsky
- 2.(1.) Humeral elytral angle unmarked; middle band fragmented on disc into several spots with very irregular edges ..... *singalensis* Horn
  - Humeral elytral angle marked with a spot; middle band not fragmented, edges entire ..... 3
- 3.(2.) Humeral elytral lunule comprised of two dots ..... 4
  - Humeral elytral lunule complete, not divided ..... 6
- 4.(3.) Apical elytral lunule incompletely formed; marginal portion of lunule narrow (on some specimens long, on others short) and separated from round basal spot ..... 5
  - Apical elytral lunule completely formed; marginal portion of lunule widened at each end and broadly connected to large rounded basal spot (on a few specimens narrowly separated) ... *brevis* Horn, new rank
- 5.(4.) Proepisterna sparsely setose on ventral three-quarters, few to no setae on dorsal quarter; marginal portion of apical elytral lunule very short, reduced to a short elongate spot restricted to outer apical angle; fourth male antennomere lacking a penicillum ..... *procera* Horn, new rank
  - Proepisterna uniformly covered by moderate to abundant appressed setae; marginal portion of apical elytral lunule long, extending from outer apical angle to suture; penicillum of clubbed bristles on fourth male antennomere ..... *bigemina* Klug
- 6.(3.) Mandible long, its apical tooth equals or exceeds one-half its entire length ..... 7
  - Mandible short, its apical tooth less than one-half its entire length .. 8
- 7.(6.) Apical elytral lunule complete ..... *cognata* Wiedemann
  - Apical elytral lunule comprised of two dots ..... *erudita* Wiedemann
- 8.(6.) Humeral elytral lunule joining middle band by a marginal line .... 9
  - Humeral elytral lunule separated from middle band ..... 11
- 9.(8.) Apical end of elytral middle band extending posteriorly along suture nearly to apical lunule; anterior portion of apical lunule long, slightly sinuate, extending medially more than halfway toward transverse portion of middle band ..... *venosa* Kollar
  - Apical end of elytral middle band not extending along suture posteriorly; anterior portion of apical lunule short, recurved, extending medially for only a short distance ..... 10
- 10.(9.) Distal end of humeral elytral lunule abruptly recurved at an acute angle; female mesepisternal coupling sulcus a shallowly impressed groove slightly behind middle ..... *ancistridia*, new species

- Distal end of humeral elytral lunule gradually recurved; female mes-episternal coupling sulcus a small, deeply impressed groove slightly behind middle ..... *agnata* Fleutiaux
- 11.(8.) Humeral elytral lunule projecting to middle of elytral disc and ending in a bulge ..... *grammophora* Chaudoir
- Humeral elytral lunule projecting only slightly mesad and not ending in a bulge ..... *minuta* Olivier

### *Cicindela (Eugrapha) bigemina* Klug

*Cicindela bigemina* Klug, 1834:30.

*Type status.* Holotype, female! *Type depository.* Holotype at MNHB. *Type locality.* Reported unknown in original description.

*Cicindela tremula* Audouin and Brullé, 1839:135, pl. 9, fig. 3.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* ?MNHNP. *Type locality.* "Indes Orientales."

*Cylindera (Ifasina) bigemina* (Klug): Rivalier, 1961:142.

*Cylindera (Ifasina) bigemina* (Klug): Naviaux, 1985:73, fig. 24, 59, 91.

*Cicindela (Cylindera) bigemina* Klug: Acciavatti, 1987:377.

*Nomenclatural note.*—The following published name has been associated with this species: *rufescens* Mandl, 1970:209; however, because it was neither described nor figured, it is unavailable.

*Diagnosis.*—Distinguished by the setose genae and clypeus; elytral humeral lunule comprised of two dots; marginal portion of apical elytral lunule long, extending from outer apical angle to suture; broad shallowly impressed medial groove on female mesepisterna; male antennal penicillum of clubbed bristles.

*Description.*—*General habitus.* Body small (9–10 mm); head and pronotum copper, the former with metallic green areas laterally; elytra copper-green; elytral maculae divided; body copper to copper-green ventrally. *Head.* Fourth male antennomere with penicillum of clubbed bristles; labrum testaceous, short; single medial tooth much longer on female than on male, anterior margin dark along entire length; six to ten submarginal setae; clypeus glabrous, smooth; frons with longitudinal rugae laterally becoming shallow and arcuate at center; 12 to 15 slightly to moderately raised longitudinal rugae between each eye and vertex midline; rugae shallow and inconspicuous medially; lateral rugae on frons extend past eyes to merge with vertical rugae behind eyes; eyes moderately bulging; genae glabrous, rugae numerous and parallel; last segment of labial and maxillary palpi metallic, remaining segments pale brownish to testaceous. *Prothorax.* Subquadrate; surface finely and irregularly rugose, rugae form a slightly transverse pattern on anterior reflexed margin but remain irregular on disc thereby nearly obliterating the midline except at the anterior and posterior ends; transverse sulci of pronotum moderately impressed; pronotal setae appressed and sparse laterally at anterior and posterior margins and covering lateral half of surface from medial line to lateral suture; setae at lateral margin originating from one or two irregular rows of punctures some of which nearly touch suture whereas setae more medially on disc originate from scattered inconspicuous punctures rather than in rows; proepisterna covered with moderate to abundant appressed setae originating from small setigerous punctures; prosternum glabrous, surface slightly wrinkled. *Pterothorax.* Female mesepisternal coupling sulcus a broad shallowly impressed medial groove; all sterna except mesepisterna covered with moderately abundant, appressed setae. *Elytra.* Surface densely granulate-punctate and copper-green, shallow punctures purple; humeral and apical lunules divided into extremities on most specimens (complete and then basal spot only narrowly joining apical band on a few specimens); middle band sinuate acutely bent at middle, not extended along lateral margin; elytral epipleura metallic; elytral apex microsculptate with margin nearly straight from outer apical angle to extreme apex which is slightly truncated with a small sutural spine. *Abdomen.* All sterna on male and all except last on female covered with abundant appressed setae except at middle which has only long primary setae. *Legs.* Trochanters dark brown, posterior pair mostly greenish metallic tinged, one subapical seta on each front and middle segment; femora metallic copper-green; tibiae and tarsomeres greenish. *Male genitalia.* Aedeagus moderately stout, nearly of uniform width for apical three-quarters and tapering only slightly to a broadly rounded

apex; small protuberance originating from a semisclerotized beak on the right side bending to the left perpendicular to main axis; longitudinal flange near apex on left and right lateral aspects.

**Distribution.**—(Fig. 58). Pakistan (Northwest Frontier), India (Jammu and Kashmir, Punjab, Uttar Pradesh, Madhya Pradesh, Bihar, West Bengal, Karnataka) and Nepal.

**Localities.**—INDIA: Haryana: 10 km S Chandigarh, 26.VII.1982, grassland (DLPC); 10 km S Chandigarh, 15.VII.1982, sandy river bar (DLPC); Himachal Pradesh: 10 km N Kiratpur, 25.VII.1982, sandy river bar (DLPC); Uttar Pradesh: 20 km NW Dehra Dun, 30.VI.1983, forest path (DLPC); Muzaffarnagar, 1.VII.1982, sandy river bar (DLPC); West Bengal: 15 km N Siliguri, 3.VI.1985, sandy river beach (DLPC); Bihar: 40 km S Palamau, 22.VI.1986, sandy river beach (DLPC); Karnataka: 20 km W Dharwar, 18.VII.1986, sandy river beach (DLPC). NEPAL: Kathmandu Valley: Bagmati River N Chowbar Gorge, VIII.1971 (CMNH); Kakni, 2160 m, VI.1972 (CMNH); Sildhunga, 33 km W Jiri, 925 to 1230 m, 20.IX.1971 (CMNH); 34 km W Kathmandu, 26.V.1986, sandy river beach (DLPC); Kathmandu Valley, western part, 1300 to 1900 m, IX.1969 (CMNH); Sauraha, Chitwan Royal Park, 28.V.1986, sandy river beach (DLPC); Nagarkot, 1800 to 2000 m, 26.VI.1980 (CMNH); Dhading District: west of Samari Banjyang, Topal Khola, 1000 to 1200 m, cultivated land, 23.VII.1983 (SMFM, CMNH).

**Ecology.**—Adults typically occur along grassy edges of sandy river banks. Acciavatti (1987) reported their presence in a variety of moist habitats, such as rice paddy bunds and sandy river banks. Naviaux (1985) added clay roads and fallow fields. Fowler (1912) mentioned their attraction to lights. This and the following species tend to separate by microhabitats (Pajni et al., 1984).

**Remarks.**—Although Rivalier (1961) placed this species within *Cicindela* (*Ifasina*) based primarily on the fragmented elytral pattern, our studies indicate this and its related species are more accurately placed within *Cicindela* (*Eugrapha*) because of the male genitalia shape with its small protruding apical beak and the presence of a male antennal penicillum.

The Burmese species *Cicindela* (*Eugrapha*) *bigemina iravaddica* Gestro, 1893: 351, has been considered a subspecies of *C. (Eugrapha) bigemina* by most authors (Fowler, 1912; Horn, 1926; Naviaux, 1985). Study of syntypes! (5 females, 1 male at MCSNG; 1 female at IRSNB) indicates that *Cicindela* (*Eugrapha*) *iravaddica* Gestro, new rank, represents a separate species.

*Cicindela* (*Eugrapha*) *iravaddica* through comparison with *C. (Eugrapha) bigemina* differs by: 1) the absence of a male antennal penicillum rather than the presence of a penicillum; 2) a moderately deep grooved female coupling sulcus rather than a shallowly impressed coupling sulcus; 3) the middle band shallowly sinuate and nearly transverse rather than the middle band more acutely bent at middle; 4) the apical elytral lunule having the lateral segment not reaching the suture rather than a complete apical lunule narrowly touching suture.

### *Cicindela* (*Eugrapha*) *brevis* Horn, new rank

*Cicindela bigemina brevis* Horn, 1905b:34.

**Type status.** Lectotype, female [here designated]. **Type labels.** "Ind. or." [typeset within thin black margins]; "Type!, Dr. W Horn" [two typeset lines within thin black marginal line]; "Syntypus" [typeset on orange label]; "Coll. DEI, Eberswalde" [two typeset lines]; "LECTOTYPE, *Cicindela, bigemina brevis* W. Horn, by R.E. Acciavatti, '86" [typed and handprinted red label]; "*Cicindela* (*Eugrapha*), *brevis* W. Horn, det. R.E. Acciavatti, '86" [typeset and handprinted red label]. [Lectotype is 8.5 mm.] Paralectotype, female! at DEI [here designated] labelled "PARALECTOTYPE" [typeset and handprinted red label]. **Type depository.** Lectotype and paralectotype at DEI. **Type locality.** "Ind. or." (undoubtedly northern India).

**Diagnosis.**—Distinguished by the setose genae and clypeus; elytral humeral lunule comprised of two dots; apical lunule complete with basal end rounded and

broadly connected to marginal portion on most specimens, narrowly separated on a few others; moderately deep groove dorsally along posterior margin on female mesepisterna; male antennal penicillum absent.

*Description.*—*General habitus.* Body very small to small (7–8.5 mm); head and pronotum shiny copper-green; elytra dull copper-brown (green on some specimens); elytral maculae fragmented; body metallic copper-green ventrally. *Head.* Labrum testaceous, short; one medial tooth at anterior margin on each sex, female labrum bulged on either side of tooth, bulges absent on male; anterior labral margin dark along entire edge; six to ten submarginal setae; clypeus glabrous, smooth; frons with longitudinal rugae laterally becoming shallow and arcuate at center; 8 to 11 longitudinal rugae between each eye and midline; medial rugae shallow and indistinct; lateral rugae extend from frons past eyes merging with vertical rugae behind eyes; genae glabrous, numerous parallel rugae; last segment of labial and maxillary palpi metallic; fourth male antennomere lacking penicillum. *Prothorax.* Subquadrate; surface finely rugose, slightly transverse pattern on anterior reflexed margin, irregular on disc nearly obliterating medial line except at the anterior and posterior ends; transverse sulci of pronotum moderately impressed; pronotal setae appressed and sparse laterally at anterior and posterior margins and over half of surface from medial line to lateral suture; setae at lateral margin originating from one or two irregular rows of large punctures some of which nearly touch suture whereas setae more medially on disc originate from indistinct punctures scattered rather than in rows; proepisterna covered by moderate to abundant appressed setae originating from small setigerous punctures; prosternum glabrous, surface smooth. *Pterothorax.* Female mesepisternal coupling sulcus a moderately deep groove deepest along posterodorsal margin; all sterna except mesepisterna covered by moderately abundant, appressed setae. *Elytra.* Parallel sided on male, subparallel on female; outer apical elytral margin nearly straight, margin sinuate before suture; elytral epipleura dark, shiny, slightly metallic; elytral surface granulate-punctate covered by dense, wide purple punctures, each with greenish blue halo; maculae white, pattern fragmented; humeral lunule divided in two, each end a circular spot; middle band broadly sinuate extending slightly anteriorly before turning at a right angle posteriorly then at another right angle nearly to suture, middle band widened laterally, nearly touching lateral margin; apical lunule touching lateral margin with both ends expanded, basal end broadly joined to marginal portion on most specimens, narrowly separated on a few specimens; apices microserrulate; sutural spine small. *Abdomen.* All sterna on male and all except last sternum on female covered by abundant appressed setae except nearly glabrous at middle. *Legs.* Front and middle trochanters brownish, slightly metallic purple or green tinged, one subapical seta on each front and middle segment; rear trochanters mostly metallic purple or green, glabrous; femora metallic purple-green; tibiae and tarsomeres purple. *Male genitalia.* Aedeagus moderately stout, nearly of uniform width on apical three-quarters, apex broadly rounded with a small protuberance originating from semisclerotized beak on the right and bent perpendicular to main axis, and a large, distinctly raised, longitudinal flange near apex creating a broad concavity on left and right lateral aspects.

*Distribution.*—(Fig. 58). Pakistan (Sind, Punjab) and northern India (Punjab, Himachal Pradesh, Uttar Pradesh, Haryana, Bihar).

*Localities.*—PAKISTAN: Sind: Karachi-Hyderabad Road, Keenihar Lake, 17.VII.1975 (FCC, CMNH); Punjab: VI–X (CMNH, DEI). INDIA: Bihar: Chapra (DEI); Union Territory: Chandigarh, 15.VII.1982, pond edge (DLPC); Uttar Pradesh: Muzaffarnagar, 8.VII.1982, grassland (DLPC); Muzaffarnagar, 11.VII.1982, river sand bar (DLPC); Haryana: 10 km S Chandigarh, 15.VII.1982, pond edge (DLPC, CMNH); Himachal Pradesh: 10 km N Kiratpur, 25.VII.1982, river sand bar (DLPC).

*Ecology.*—Adults occur along the grassy edges of muddy ponds, reservoirs and rivers.

*Remarks.*—*Cicindela brevis* is smaller than sympatric specimens of *C. bigemina* (Pajni et al., 1984). Furthermore, *Cicindela brevis* females possess a moderately deep mesepisternal groove compared to the shallowly impressed mesepisternal groove on *C. bigemina* females. These different types of coupling sulcus would aid reproductive isolation of the two species where sympatric.

### *Cicindela (Eugrapha) procera* Horn, new rank

*Cicindela bigemina procera* Horn, 1905b:34.

*Type status.* Lectotype, male [here designated]. *Type labels.* “Boucard, India” [handscript lines on top side, dashed lines on reverse side]; “Type!, Coll. W Horn” [two typeset lines within thin black



marginal line]; "Syntypus" [typeset orange label]; "Coll. DEI, Eberswalde" [two typeset lines]; "LECTOTYPE, *Cicindela bigemina*, procera W. Horn, by R.E. Acciavatti, '86" [typed and handprinted red label]; "Cicindela (Eugrapha), procera W. Horn, det. R.E. Acciavatti, '86" [typeset and handprinted]. [Lectotype is 8 mm and has been glued on ventral surface to pin.] Paralectotype, male! [here designated] labelled "India" [handscript on folded label]; "PARALECTOTYPE" [typed and handprinted red label]. *Type depository.* Lectotype and paralectotype at DEI. *Type locality.* "India or."

*Diagnosis.* — Distinguished by the fourth male antennomere lacking penicillum; elytral surface with only small discrete green punctures; pronotum sparsely setose laterally, setae absent at the middle of the lateral margin; proepisterna sparsely setose except nearly glabrous on dorsal quarter; copper-bronze dorsal surfaces; apical elytral lunule with only outer portion present as a short elongate spot.

*Description.* — *General habitus.* Body small (8–8.5 mm); dorsal surfaces of head and pronotum shiny copper bronze; elytra dull copper-brown, partial and divided pattern of white maculae; body metallic copper ventrally. *Head.* Fourth male antennomere lacking penicillum; labrum testaceous, short; male labrum with one medial tooth, anterior margin dark along entire length, six to ten submarginal setae; clypeus, frons, vertex and genae glabrous; frons with longitudinal rugae laterally, shallow and arcuate rugae medially; 8 to 11 longitudinal rugae between each eye and vertex midline; rugae shallow adjacent to eye, indistinct toward center; lateral rugae extend from frons past eyes to merge with vertical rugae behind eyes; last segment of labial and maxillary palpi metallic. *Prothorax.* Subquadrate; surface with fine, wavy rugae forming a slightly transverse pattern on anterior reflexed margin; rugae irregular on disc nearly obliterating medial line except at anterior and posterior ends; transverse pronotal sulci moderately impressed; pronotum with sparse, appressed setae laterally; setae most abundant at anterior and posterior margins, absent at middle of lateral margin, few setae scattered over lateral half of disc adjoining lateral margin; all setae at lateral pronotal margin originating from irregular rows of small punctures none of which touch suture; proepisterna sparsely setose ventrally, few to no setae on dorsal quarter; prosternum glabrous, surface smooth. *Pterothorax.* All sterna except mesepisterna covered with moderately abundant, appressed setae. *Elytra.* Surface punctate with small discrete green punctures; elytral epipleura dark, slightly metallic; elytral maculae white, comprised of spots and bands; humeral lunule divided, each end a circular spot; broadly transverse and slightly sinuate middle band extending slightly anteriorly then at a right angle posteriorly then at another right angle to terminate nearly at suture; middle band widened at lateral margin but not touching it; only the outer portion of marginal band present as a short, elongate spot; outer apical elytral angle with large circular spot medially; elytral apices microserulate with sutural spine small, distinct. *Abdomen.* All sterna on male covered with abundant appressed setae except at middle which is nearly glabrous. *Legs.* Trochanters brownish tinged slightly metallic purple, one subapical setae on each front and middle segment; femora metallic purple green; tibiae and tarsomeres purple. *Male genitalia.* Aedeagus stout, nearly of uniform width on apical three-quarters, apex blunt; long protuberance originating from semisclerotized beak on the right bent nearly perpendicular to main axis; moderately raised and slightly sinuate, longitudinal flange below beak creating a broad concavity on left and right lateral aspects.

*Distribution.* — Specific localities for *Cicindela procera* have not been reported. Except for the male syntypes, no other specimens have been reported in the literature nor seen by us in collections. Although Horn designated the type locality as "India or." in his description, his syntypes are labelled as "India", indicating his uncertainty about their origins. It is possible that this species is not actually from the Indian subcontinent but occurs elsewhere in the Oriental biogeographic region.

*Ecology.* — The habitat of this species is unreported but adults probably occur near water like related species.

*Remarks.* — *Cicindela procera* is known only from the two syntypic males as no other published records exist nor have we seen any other specimens. From our study of these syntypes, we conclude that *Cicindela procera* deserves species rank and is more closely related to *C. brevis* than to *C. bigemina*.

*Cicindela procera* shares with *C. brevis* the lack of a male antennal penicillum but through comparison differs by: 1) the elytral surface being punctate with smaller discrete green punctures rather than granulate-punctate with large purple



punctures; 2) the pronotum having sparser lateral setae which are absent at the middle of the lateral margin rather than the more abundant appressed setae at the lateral margin and onto the disc; 3) the proepisterna having sparser to nearly absent setae on the dorsal quarter rather than appressed setae over the entire surface; 4) the dorsal surfaces copper-bronze rather than the copper-brown to green; 5) the apical elytral lunule having only the outer portion present as a short elongate spot rather than a complete apical lunule.

### *Cicindela (Eugrapha) minuta* Olivier

*Cicindela minuta* Olivier, 1790:31, pl. 2, fig. 13a, b.

*Type status.* Syntype(s)? [unexamined; concept based on a comparison of its description and illustration with specimens labelled "Vietnam, Mekong Delta, Con Cat Island, 19.VII.1981", at CMNH]. *Type depository.* Unrecorded. *Type locality.* "Indes Oriental."

*Cicindela baltimorensis* Herbst, 1806:181, pl. 172, fig. 3.

*Type status.* Lectotype, female [here designated]. *Type labels.* "3700" [typeset]; "pumila Dej., C. baltimorensis, Ht., Java, Westerm. de Haan." [five manuscript lines on gray label with black marginal line]; "Zool. Mus., Berlin" [two typeset lines]; "LECTOTYPE, *Cicindela, baltimorensis* Herbst, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 7 mm; missing left middle leg.] Paralectotypes, three males! at MNHB [bearing same locality and numeral label as lectotype] each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository.* Lectotype and three paralectotypes at MNHB. *Type locality.* "Baltimore" (erroneous).

*Cicindela tremebunda* MacLeay, 1825:12.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* Unrecorded. *Type locality.* "Java."

*Cicindela pumila* Dejean, 1826:425.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* ?MNHN. *Type locality.* "Egypt."

*Cicindela prinseprii* Saunders, 1836:65, pl. 7, fig. 7.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* Unrecorded. *Type locality.* "Ackra, near Calcutta" (West Bengal, India).

*Cicindela acuminata* Kollar, 1836:331.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* Unrecorded. *Type locality.* "India Orientali."

*Cylindera (Eugrapha) minuta* (Olivier): Rivalier, 1961:143.

*Cylindera (Eugrapha) minuta* (Olivier): Naviaux, 1985:75, fig. 33, 67, 96.

**Diagnosis.**—Distinguished by the very small to small body; complete, separate and short humeral lunule which does not extend to middle of elytral disc; male antennal penicillum.

**Description.**—*General habitus.* Body very small to small (7–8.5 mm); head and pronotum shiny copper or copper-green dorsally, metallic blue-green reflections laterally; elytra dull green and copper, standard but narrow pattern of maculae; body copper ventrally. *Head.* Male antennal penicillum with one to three clubbed bristles on fourth antennomere; labrum very short, transverse, entirely testaceous with one minute medial tooth; eight to ten submarginal setae; frons with fine, parallel, longitudinal rugae extending laterally onto vertex; 8 to 12 mostly complete ridges moderately raised between each eye and vertex midline; rugae fine and irregular medially on vertex; eyes bulging; frons, vertex and genae glabrous. *Prothorax.* Pronotum finely sculptured, lacking rugae on disc, numerous, long appressed setae laterally; proepisterna covered by dense erect setae. *Pterothorax.* Female mesepisternal coupling sulcus a narrow groove, deepest medially. *Elytra.* Surface granulate-punctate with deep blue punctures; standard pattern of narrow maculae, on some specimens obscure; humeral lunule separate, apical end not reaching middle of elytral disc; apical lunule complete; middle band joining basally and apically

expanded marginal band; elytral epipleura nometallic; testaceous; elytral apices microserulate, margins separately rounded before apex, more so on female than male; sutural spine small. *Abdomen*. All sterna on each sex covered with abundant appressed setae which are denser laterally. *Legs*. Trochanters dark brown with a metallic purple or green tinge which often predominates especially on rear pair, one subapical seta on each front and middle segment; femora metallic purple green; tibiae and tarsomeres purple. *Male genitalia*. Aedeagus moderately stout, nearly of uniform width on middle half before tapering gradually on apical quarter to a small, rounded apex with a long, nearly straight, semisclerotized beak on the right supported by a long, distinctly raised, longitudinal flange extending basally from apex for about one-quarter of the entire length and creating a broad concavity on left and right lateral aspects.

*Distribution*.—(Fig. 59). This species is found over most of the Indian subcontinent (except Pakistan and Sri Lanka) and it ranges into Southeast Asia and Indonesia.

*Localities*.—INDIA: Uttar Pradesh: Bijnor, 8.VII.1982 (DLPC); West Bengal: 25 km N Siliguri, 2.VI.1985, sandy river beach (DLPC); Andhra Pradesh: 29 km E Narsipatnam, 24.VIII.1985, sandy river edge (DLPC); 60 km NW Tuni, 1.VII.1986, sandy river edge (DLPC); Karnataka: 50 km W Mudigere, 31.V.1985 (DLPC); 30 km S Kanakapura, 16.V.1985, sandy river beach (DLPC); 60 km NE Mangalore, 30.V.1985 (DLPC); Sringeri, 650 m, 8.VI.1987, sandy river bank (DLPC); Dharwar, 28.VII.1985 (DLPC); Gujarat: 22 km N Vadodara (Baroda), 10.X.1985 (DLPC); 11 km SE Dabhoi, 11.X.1985 (DLPC); Kerala: Walayar Forest, 215 m, IX.1976 (CMNH); 15 km E Palghat, 19.V.1985, sandy river beach (DLPC); Kuttyadi, 29.X.1984, at river (DLPC); Quilon District, Thenmalai, 170 m, V, VI.1985 (CMNH); Tamil Nadu: Pugalur, 6.XI.1984 (DLPC); Tanjore District, Nedungadu, 31.IV.1938 (CMNH); Union Territory: Pondicherry, Karikal, Kurumbagaram, 21.I.1947 (CMNH). BANGLADESH: Dinajpur District: Dinajpur (CMNH). NEPAL: Kathmandu Valley: 15 km S Sauraha, 28.V.1986, sandy river edge (DLPC); 51 km W Kathmandu, 26.V.1986, sandy river edge (DLPC); Bagmati N Chowbar Gorge, VIII.1971 (CMNH); Chitwan District: Chitwan Road at Lothar river, IX.1971 (CMNH). INDONESIA: Java: Buitensorg, X.1931 (ANIC); Sumatra (ANIC). VIETNAM: Hanoi, 22.V–10.VI.1986 (CMNH); Mekong Delta, Con Cat Island, 19.VII.1981 (CMNH). KAMPUCHEA: Near Luong, 15.VI.1962 (CMNH).

*Ecology*.—Adults of this ubiquitous species most commonly occur near water with muddy edges, often in wet grassy areas, but also far from vegetation.

### *Cicindela (Eugrapha) cognata* Wiedemann

*Cicindela cognata* Wiedemann, 1823:66.

*Type status*. Lectotype, female [here designated]. *Type labels*. "238" [typeset]; "Bengal. Nietn." [handscript on large yellow label with black marginal line]; "Zool. Mus., Berlin" [two typeset lines]; "LECTOTYPE, *Cicindela, cognata* Wiedemann, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype missing prothorax and head; remainder of body is 7 mm.] [Zimsen (1954) indicated the type of *C. cognata* was lost; however, there is no reason to doubt the syntypic authenticity of the specimen at MNHB, given that certain of Wiedemann's types are deposited there. This species has distinctive elytral markings such that what remains of the lectotype provides diagnostic characters for distinguishing this species from other *Cicindela (Eugrapha)* species.] *Type depository*. Lectotype at MNHB. *Type locality*. "Bengal."

*Cicindela triramosa* Kollar, 1836:330.

*Type status*. Lectotype, female [here designated]. *Type labels*. "F." [handscript]; "Madras, typ !!" [handscript]; "Type!, Coll W Horn" [two typeset lines within a thin marginal line]; "ex coll., Wien. Mus." [handscript lines with red and blue lines on one end]; "Syntypus" [typeset red label]; "Coll. DEI, Eberswalde" [typeset]; "LECTOTYPE, *Cicindela, triramosa* Kollar, by R.E. Acciavatti, '85" [typed and handprinted red label], "*Cicindela cognata cognata* Wiedemann det. R.E. Acciavatti, 1985" [typeset and handprinted]. [Lectotype is 9.5 mm with right antenna missing beyond third segment, and left front and middle right tarsomeres missing.] *Type depository*. Lectotype at DEI. *Type locality*. "India Oriental, (in Madras)."

*Cicindela cognata* Wiedemann: Fowler, 1912:364, fig. 158.

*Cicindela cognata* Wiedemann. Horn, 1926:171.

*Cylindera (Eugrapha) cognata* (Wiedemann): Rivalier, 1961:143.

*Cylindera (Eugrapha) cognata* (Wiedemann). Naviaux, 1985:74, fig. 29, 63, 95.

**Diagnosis.**—Distinguished by the apical mandible tooth equal to or exceeding one-half the entire mandible length; apical elytral lunule complete.

**Description.**—*General habitus.* Body small (9–10 mm); dorsum dull green, head and pronotum copper dorsally with green reflections laterally; elytra dark black-green with three complete and separate lunules; body metallic blue-green ventrally. *Head.* Antennal scape with one subapical seta; mandible with apical tooth extremely long, equal to or exceeding remainder of mandible in length, second tooth from base distinctly shorter than first or third; labrum short, white, eight to ten submarginal setae and one acute medial tooth; frons, genae and vertex entirely glabrous except for two pairs of supraorbital setae; vertex finely sculptured except for eight to ten moderately raised rugae between each eye and middle. *Prothorax.* Proepisterna with dense appressed setae on ventral three-quarters to two-thirds, dorsal quarter to one-third glabrous; pronotal disc finely sculptured, nearly smooth, with transverse sulci shallow, pronotum laterally and on anterior and posterior corners with long appressed setae originating from irregular, multiple rows of minute setigerous punctures; prosternum glabrous. *Pterothorax.* Female mesepisterna broadly concave; remaining sclerites covered with long, dense appressed white setae. *Elytra.* Maculae consisting of complete humeral and apical lunules with enlarged medial projections; the middle portion of the humeral lunule narrowed and transverse; middle band sinuate and slightly dilated at each end and at middle where it bends abruptly toward apex; maculae not expanded along the lateral margin; surface granulate-punctate but punctures are shallow and their purple color contrasts only slightly with remainder of surface; elytral epipleura metallic purple; apex microsculptured with a small sutural spine somewhat retracted from the edge which is quite rounded just before the suture. *Abdomen.* Sterna almost entirely covered by appressed white setae except for scant hairs at middle. *Legs.* Trochanters dark violet, one subapical setae on each front and middle segment; femora dark metallic blue-green tinged with purple; tibiae and tarsomeres purple. *Male genitalia.* Aedeagus gradually enlarged on basal third, widest and nearly of uniform width on apical two-thirds with a broad, blunt apex which terminates with a short, lightly sclerotized beak separated from membranous apical orifice by a narrow notch; a distinct, longitudinal sclerotized flange present on left and right lateral aspects, below notch on the right.

**Distribution.**—(Fig. 58). India (Tamil Nadu, Punjab, Haryana, Uttar Pradesh, Bihar, Andhra Pradesh, West Bengal, Orissa), Nepal and Bangladesh.

**Localities.**—INDIA: Haryana: New Delhi environs, 4.IX.1968, light trap (CMNH); Uttar Pradesh: Muzaffarnagar, 11.VII.1982, river sand bar (DLPC, CMNH); Union Territory: New Delhi, 31.VIII.1981, night light (DLPC); New Delhi, IARI, 4.X.1968, light trap (NMNH, CMNH); Bihar: 85 km W Ranchi, 23.VI.1986, moist creek bed (DLPC); Andhra Pradesh: Araku, 900 m, 23.VIII.1985 and 29.VI.1986, sandy river beach (DLPC). NEPAL: Dhading District: Ankhu Khola Valley, from Ankhu Sangu to Sellentar, 530 to 750 m, cropland, streambank/shore, 26.VII.1983 (SMFM). BANGLADESH: Dhanjuri District: Dhanjuri, 1963 (CMNH).

**Ecology.**—Adults frequent moist grassy areas and sandy bars of rivers near vegetation. Naviaux (1985) also reported its occurrence locally in the wet areas behind beaches along rivers.

**Remarks.**—*Cicindela (Eugrapha) cognata* is closely related to the Southeast Asian *Cicindela (Eugrapha) mutata* Fleutiaux, 1893b:486, based on specimens! from Tak, Thailand, at CMNH. Although the shape of the male genitalia is virtually identical, the two forms are widely separated geographically. The two species differ in the dorsal color, elytral maculae and microsculpture and proepisternal pilosity; *C. mutata* is brownish dorsally and copper ventrally with small, distinctive elytral punctures with contrasting blue-green punctures and only minute granulae and its markings are narrower, the proepisterna are completely covered by sparse appressed setae; *C. cognata* has large closely spaced bluish purple noncontrasting punctures with large granulae and its markings are wide; the dorsal quarter to one-third of the proepisterna is glabrous. Fowler (1912), and later Rivalier (1961), considered *C. mutata* and *C. cognata* distinct; our studies support this relationship rather than the subspecific one proposed by Horn (1926).

*Cicindela (Eugrapha) erudita* Wiedemann

*Cicindela erudita* Wiedemann, 1823:68.

*Type status.* Lectotype, male [here designated]. *Type labels.* "Mus. Westerm." [typeset]; "♂" [printed small square]; "Bengal., Juni 1809. Erudita, Wied" [handscript]; "Zool. Museum, DK Copenhagen" [typeset]; "LECTOTYPE, *Cicindela, erudita* Wiedemann, by R.E. Acciavatti, '83" [typed and printed red label]. [Lectotype is 8 mm; right front leg missing.] Paralectotypes, two females! (one each at ZMUC, and MNHB) each [here designated] labelled "PARALECTOTYPE" [typed and printed red label]. [Although Zimsen (1964) did not mention this species among Wiedemann's types at ZMUC, it seems certain that these two syntypes were simply overlooked when the list was compiled.] *Type depository.* Lectotype and one paralectotype at ZMUC; one paralectotype at MNHB. *Type locality.* "Bengal" (India).

*Cicindela amabilis* Dejean, 1831:228.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* ?MNHNP. *Type locality.* "Indes Orientales."

*Cicindela chloropus* Audouin and Brullé, 1839:134, pl. 9, fig. 2.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* ?MNHNP. *Type locality.* "Bengale."

*Cicindela erudita* Wiedemann: Fowler, 1912:362, fig. 156.

*Cicindela amabilis* (sic) Wiedemann: Heynes-Wood and Dover, 1928:85.

*Cylindera (Eugrapha) erudita* (Wiedemann): Rivalier, 1961:143.

*Cylindera (Eugrapha) erudita* (Wiedemann): Naviaux, 1985:74, fig. 28, 62, 93.

*Nomenclatural note.*—The following published name has been associated with this species: *erythropus* Schaum, 1863:63; however, because it was neither described nor figured, it is unavailable.

*Diagnosis.*—Distinguished by the long apical tooth of the mandible equaling or exceeding one-half the entire mandible length; apical elytral lunule divided in two.

*Description.*—*General habitus.* Body small (8–10 mm); head and pronotum copper (on some specimens copper-red) dorsally, bright green to purple laterally; elytra basally along suture shiny green to copper-green, remainder dull, deep blue to blue-black; broad elytral maculae, lunules complete; body metallic blue ventrally. *Head.* Antennal scape with one subapical seta; fourth antennal segment of male lacking a penicillum of clubbed bristles; mandible with apical tooth extremely long, equal to remainder of mandible in length, second tooth from base distinctly shorter than first or third; labrum short, white except for a dark anterior edge, 8 to 11 submarginal setae and one acute medial tooth on each sex; frons, genae and vertex entirely glabrous except for two pairs of supraorbital setae; vertex finely sculptured except for eight to ten mostly complete and coarsely raised ridges between each eye and middle of vertex. *Prothorax.* Pronotum subquadrate, surface with fine and irregular rugae and with shallow and narrow transverse sulci, laterally with numerous short, dense white setae originating from several irregular rows confined to area near margin; proepisterna with dense appressed setae on ventral half, dorsal half smooth, glabrous; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a broad shallow groove. *Elytra.* Elytral surface granulate-punctate basally gradually becoming nearly impunctate apically; maculae white and broad, the humeral lunule and middle band separate, apical lunule with anterior portion enlarged, rounded and separated from the apical portion; elytral epipleura on most specimens metallic purple, on some specimens dark brown tinged with metallic purple; elytral apices microserrulate, margins gradually and separately rounded at extreme apex, more so on female than male, sutural spine small. *Abdomen.* Anterior five sterna on female and all sterna on male, entirely covered laterally by appressed white setae, medially with only a few hairs. *Legs.* Trochanters dark brown with a metallic blue-green tinge on front pair, but mostly metallic blue-green on rear pair; one subapical seta on each front and middle segment; femora dark metallic blue-green tinged with purple; tibiae and tarsomeres purple. *Male genitalia.* Aedeagus gradually enlarged on basal third, widest and nearly of uniform width on apical two-thirds with a broad, truncate apex ending on the right in left lateral aspect; short lightly sclerotized beak separated from membranous apical orifice by a narrow notch; wide longitudinal and slightly sinuate sclerotized flange below notch on the right creates a broad concavity medially in left and right lateral aspects.

*Geographic variation.*—Specimens from central Nepal tend to be more brightly colored with purple and copper-red between the eyes, on the pronotum and basally on elytra compared with duller, dark specimens from Punjab and Haryana India.

*Distribution.*—(Fig. 59). Northern India (Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Bihar, West Bengal, Assam) and Nepal.

*Localities.*—INDIA: Uttar Pradesh: Hardwar, 10.VII.1982, grassland (DLPC); 20 km NE Saharanpur, 28.VI.1983, sandy river beach (DLPC); Muzaffarnagar, 8.VII.1982, grassland (DLPC); Union Territory: Chandigarh, 1.VII.1982, sandy river beach (DLPC); Chandigarh, 29.VII.1982, grassland (DLPC); New Delhi, IARI, 22.VIII.1968, light trap (NMNH, CMNH); Haryana: 10 km S Chandigarh, 26.VII.1982, grassland (DLPC, CMNH); Punjab: 17 km N Rajpura, 27.VII.1982, grassland (DLPC). NEPAL: Sildhunga, 33 km W Jiri, 925 to 1230 m, 20.IX.1970 (CMNH); Myagdi District: Dhawalagiri, Kal-Gandaki-Khola, Tatopani, 1100 to 1400 m, 27, 28.VI.1986 (JPC, CMNH); Arun Valley, Tumlingtar-Sultibari, 500 to 1000 m, 10.VI.1988 (CMNH); Sultibari, 500 m, 11–14.VI.1988 (CMNH).

*Ecology.*—Adults occur on moist, open grassy areas from June through July.

### *Cicindela (Eugrapha) agnata* Fleutiaux

*Cicindela agnata* Fleutiaux, 1890:168.

*Type status.* Lectotype, female [here designated]. *Type labels.* “♀” [printed small square]; “Asansol, P. Cardon” [handscript yellow label]; “C. agnata Fleut., det. E. Fleutiaux” [handscript and typeset]; “cf. R. Soc. Ent. Belg., 1890, p. 168” [handprinted]; “Para-, type” [typeset orange label]; “LECTOTYPE, *Cicindela, agnata* Fleutiaux, by R.E. Acciavatti, '83” [typed and handprinted red label]. [Lectotype is 8.5 mm.] Paralectotype, male! [here designated] labelled “PARALECTOTYPE” [typed and handprinted red label]. *Type depository.* Lectotype and paralectotype at IRSNB. *Type locality.* “Asansol” (India).

*Cicindela agnata* Fleutiaux: Fowler, 1912:367, fig. 160.

*Cylindera (Eugrapha) agnata* (Fleutiaux): Rivalier, 1961:143.

*Cylindera (Eugrapha) agnata* (Fleutiaux): Naviaux, 1985:75, fig. 31, 65, 97.

*Diagnosis.*—Distinguished by the elytral humeral lunule and middle band being joined laterally; distal end of humeral lunule gradually recurved.

*Description.*—*General habitus.* Body small (9–10 mm); head and pronotum shiny copper-brown dorsally, green reflections laterally; elytra dull brown to greenish; standard pattern of maculae forming sinuate lunules; body copper-green ventrally. *Head.* Fourth male antennomere with penicillum of clubbed bristles; mandible with apical tooth shorter than half of the entire mandible length; labrum short, white, with 10 to 12 submarginal setae and either lacking a medial tooth or with only a small, rounded bulge medially on each sex; numerous slightly raised ridges between each eye and vertex midline; vertex finely sculptured medially; eyes flattened and bulging outward; frons, genae and vertex glabrous. *Prothorax.* Pronotum quadrate, surface finely sculptured with shallow and narrow transverse sulci; laterally very long, sparse white setae originate from several irregular rows near margin, and extend halfway to middle; proepisterna with dense appressed setae which obscure the entire surface; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a deeply impressed groove along posterior margin; pleura and sterna, except mesepisterna, nearly obscured by dense, decumbent white setae. *Elytra.* Dull brown except for copper suture and white maculae consisting of complete humeral and apical lunules (anterior portion of apical lunule recurved and extending medially for a short distance) and a sinuate middle band with apical end not extending along suture; all maculae connected laterally by a narrow white marginal line, on a few specimens divided just before apical lunule; elytral epipleura testaceous; elytral apices microserrulate, margins gradually and separately rounded on female, conjointly rounded on male; sutural spine prominent. *Abdomen.* Anterior five sterna on female and all sterna on male entirely covered laterally by decumbent white setae, medially with a few hairs. *Legs.* Trochanters pale brown testaceous on front and middle pair, posterior pair tinged metallic blue-green; one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic copper green. *Male genitalia.* Aedeagus moderately stout, gradually enlarged and nearly of uniform width on middle half before tapering abruptly on apical quarter to a broadly truncated apex with a short, rounded, semisclerotized beak on the right; a long, wide, longitudinal and slightly sinuate,

sclerotized flange extends basally from apex for about one-quarter the entire length and creates a broad concavity on apical quarter in most of left and right lateral aspects.

*Geographic variation.*—A single female specimen! from Kunlong, Burma, at CMNH, was found to be smaller than females from farther west. In addition, its mesepisterna had a deep elongate depression rather than the deeply grooved type of coupling sulcus characteristic of Indian populations of *Cicindela agnata*. However, until more Burmese specimens are studied, it is prudent not to consider it different, but only as falling within our concept of *Cicindela agnata*.

*Distribution.*—(Fig. 60). India (Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Orissa, West Bengal, Bihar, Haryana, Punjab) into Pakistan (Baluchistan) and northern Burma.

*Localities.*—INDIA: Union Territory: Chandigarh, 1.VII.1983, river sand beach (DLPC); Chandigarh, 30.VII.1982, river sand bar (DLPC, CMNH); Uttar Pradesh: 20 km NE Saharanpur, 28.VI.1983, sandy river beach (DLPC); Saharanpur, 27.VII.1983, river sand bar (CMNH); Punjab: 17 km N Rajpura, 27.VII.1982, sandy river bar (DLPC, CMNH); Karnataka: Kanakapura, 17.XI.1983, sandy river bank (DLPC); Tamil Nadu: 16 km S Karur, 6.XI.1982 (DLPC, CMNH); Andhra Pradesh: Vijayawada, 16.VII.1985, sandy river edge (DLPC); 5 km N Srungavarapukota, 150 m, 22.VIII.1985, sandy river edge (DLPC); Bihar: 90 km W Ranchi, 23.VI.1986, sandy river edge (DLPC). BURMA: Kunlong, 29.I.1942 (CMNH).

*Ecology.*—From June through November, adults of this species occur on extensive sand bars along rivers. They are also reported on coastal sand dunes but not on the beaches of Orissa (Fowler, 1912).

*Remarks.*—Populations of this species from Laos have been previously considered as *Cicindela (Eugrapha) cognata biprolongata* Horn, 1924b:15. Based on females! of this taxon from Laos, Luang Prabang, 300 m, 4–5.VI.1960, light trap (BPBM), and Laos, Paklay, 21.VI.1929 (RDWC), we propose its elevation to species as *Cicindela (Eugrapha) biprolongata* Horn, new rank. In comparison with *Cicindela agnata*, adult females of *C. biprolongata* possess: 1) a shorter groove type coupling sulcus deeply impressed only near ventral margin; 2) the differently shaped middle band and marginal line which end before reaching the apical lunule.

### *Cicindela (Eugrapha) ancistridia*, new species

*Diagnosis.*—Distinguished by the humeral lunule recurved abruptly toward elytral base, ending medially with a bulge; medium body size; female mesepisternal coupling sulcus a shallowly impressed dorsoventral groove behind middle.

*Description.*—*General habitus.* (Fig. 34). Body medium (11 mm); shiny copper head and pronotum; elytra copper-green with maculae forming a standard pattern joined along lateral margins; body copper-green ventrally. *Head.* Vertex, frons and clypeus glabrous, copper with lateral margins tinged with green; genae copper, glabrous with numerous rugae; labrum short, unpigmented, feebly unidentate with 9 to 12 erect submarginal setae; dorsal surface with many fine rugae with those midway between eye and center most distinct; antennal scape with one erect subapical seta; only apical half of terminal segment of maxillary and labial palpi pigmented. *Prothorax.* Dorsal outline subquadrate; copper dorsally and laterally; pronotum with fine rugae; medial sulcus shallow; anterior and posterior transverse sulci shallow, somewhat obliterated at middle; disc glabrous; laterally abundant, very long appressed setae originate from many rows of small, setigerous punctures and extend onto posterior margin of head and cover most of disc laterally; proepisterna covered with dense appressed setae; prosternum glabrous, polished, slightly golden. *Pterothorax.* Mesepisterna of female polished, golden, nearly glabrous except for a few setae at posterior margin; coupling sulcus a shallow dorsoventral groove slightly behind middle, slanting posteriorly; remaining sclerites laterally covered with dense, white, appressed setae; scutellum copper. *Elytra.* Sides subparallel, widest at apical quarter; apical margin finely microsculptate; slightly indented at prominent sutural spine; maculation pale, translucent, all lunules connected along lateral margin; humeral lunule wide basally with apical third widened to a large bulge and abruptly recurved toward base; middle band distinct, long, sinuate through middle



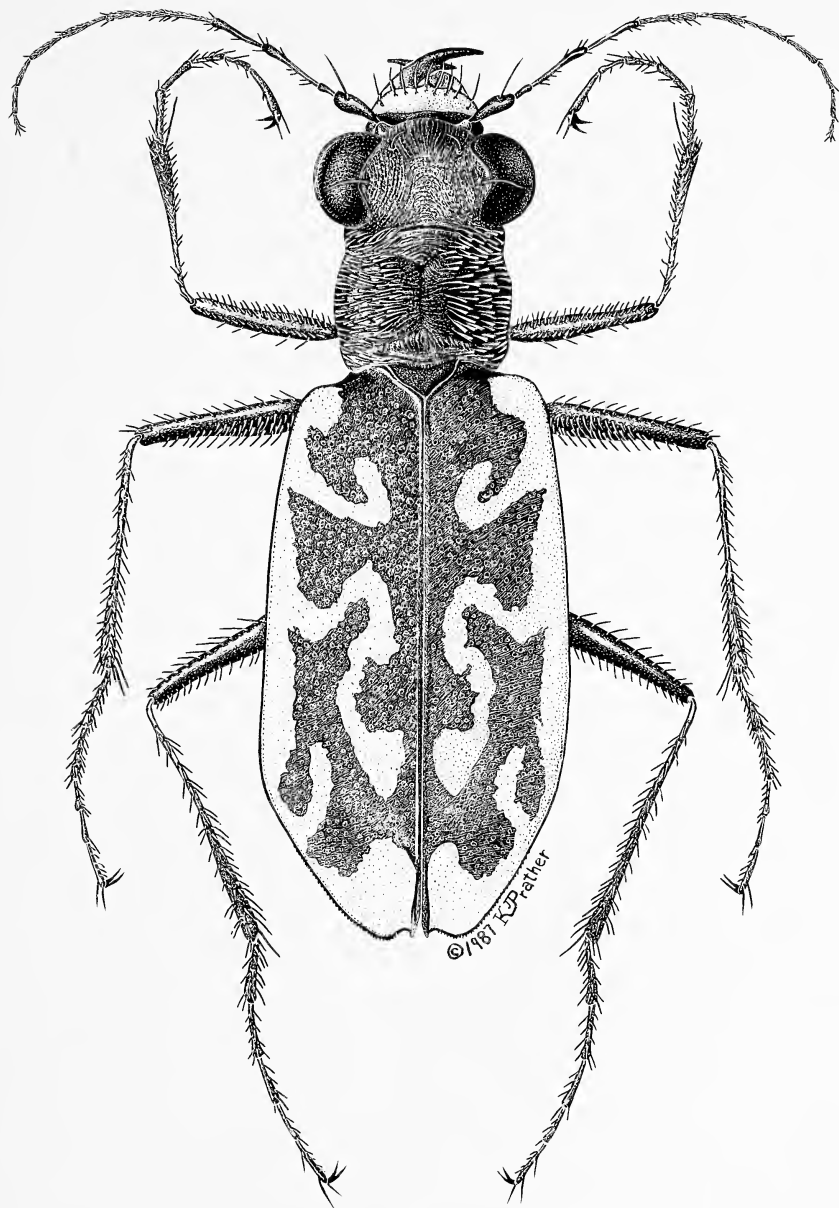


Fig. 34.—*Cicindela (Eugrapha) ancistridia*, new species, female holotype from 15 km SW Chandigarh, Punjab, India. (Body size, 11.0 mm.)

of elytra with irregular margins and ending in a bulge at apical quarter almost touching suture; apical lunule with anterior end elongate, slightly curved toward lateral margin and projecting basally past end of middle band, apical end as a broad expansion along suture; pigmented area dull, copper-green, surface densely and uniformly covered with shallow, greenish-blue punctures; suture golden and impunctate. *Abdomen*. Anterior five sterna with dense, white appressed setae laterally, glabrous medially; sixth sternum covered with sparse erect hairs. *Legs*. Coxae with dense, white setae; trochanters testaceous, one subapical seta on each front and middle segment; femora metallic copper, long ap-



pressed setae and erect spines; tibiae testaceous with erect spines; tarsomeres testaceous with darkened, slightly metallic green apices and long erect hairs. *Male genitalia*. Not examined.

*Body size*.—*Holotype*. Body length 11.0 mm, elytral width 3.8 mm.

*Type locality*.—15 km southwest of Chandigarh, Ghaggar River behind Chhatbir Zoo, Punjab State, India.

*Type specimens*.—*Holotype*, female, labelled "F: CICINDELIDAE, N: *Cylindera sublacerata*, S: Wet sand of Ghaggar (River), L: Behind Chhatbir Zoo, D: VII-26-1982" [five handprinted lines]. Female paratype, same data as holotype. [Paratype missing several apical abdominal sterna.] [Holotype and paratype are the specimens discussed by Pajni *et al.* (1984) under *Cicindela agnata*.]

*Type depository*.—*Holotype* to NMNH; paratype to BMNH.

*Distribution*.—(Fig. 59). Known only from the type locality in Punjab, India.

*Ecology*.—Adults were collected on wet sand along the Ghaggar River together with *Cicindela agnata*.

*Etymology*.—Name derived from Greek *ancistr-* (a fish hook) and *-idia* (diminutive suffix) with reference to the shape of the humeral elytral lunule.

*Remarks*.—*Cicindela ancistridia* superficially resembles *Cicindela agnata* but by comparison differs in these important characters: 1) female mesepisterna coupling sulcus a shallow dorsoventral groove slightly behind middle, slanting posteriorly rather than a deeply impressed groove along posterior margin; 2) humeral lunule curves abruptly toward base and ends on disc with enlarged bulge rather than curving only slightly with no more than a slight bulge at end; 3) noticeably larger body size than *C. agnata*.

### *Cicindela (Eugrapha) venosa* Kollar

*Cicindela nitida* Wiedemann 1821:117 (preoccupied, Lichtenstein, 1796:32).

*Type status*. Lectotype, male [here designated]. *Type labels*. "Mus. Westerm." [typeset]; "Type" [typeset red label]; "Bengal, juli 1809, Nitida Wied." [handscript]; "Zool. Museum, DK Copenhagen" [typeset]; "LECTOTYPE, *Cicindela, nitida* Wiedemann, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 8 mm.] Paralectotypes, (two females!, one male! at ZMUC, three males! and one female! at MNHB) each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository*. Lectotype and three paralectotypes at ZMUC; four paralectotypes at MNHB. *Type locality*. "Bengal."

*Cicindela venosa* Kollar, 1836:331.

*Type status*. Syntype(s)? [unexamined; concept based on comparing its description with specimens! labelled "INDIA, Uttar Pradesh, Bijnor, 11.VII.1982, river sand bar" in DLPC]. *Type depository*. Unknown [apparently not at MNHB (F. Hieke, personal communication, 1983)]. *Type locality*. "Georgia America" (erroneous).

*Cicindela venosa* Kollar: Fowler, 1912:147, fig. 367.

*Cylindera (Eugrapha) venosa* (Kollar): Rivalier, 1961:143.

*Cicindela venosa atroptera* Mandl, 1963:113, new synonymy.

*Type status*. *Holotype*, female! *Type labels*. "West Pakistan, Rawalpindi Umg., Dhok Pathan (Sohan R.), b. Pindi Gheb 17.II.56, Chr. Lindemann, leg." [five typeset lines except handprinted date]; "Holo-, type *Cicindela, venosa* ssp., *atroptera* m., Ing. K. Mandl 1961" [all but second of five lines handprinted on orange label, only upper side orange]; "*Cicindela, venosa atroptera*, Mandl, det. R.E. Acciavatti, 1987" [typeset]. *Type depository*. *Holotype* at ZSBS. *Type locality*. "Dhok Pathan (Sohan River) near Pindi (Gheb) vicinity Rawalpindi, Pakistan."

*Cylindera (Eugrapha) venosa* (Kollar): Naviaux, 1985:75, fig. 32, 66, 98.

*Nomenclatural note*.—A female paralectotype! of *Cicindela nitida* agrees with *Cicindela atroptera* in the black body color; therefore, we interpret *Cicindela*

*atroptera* as falling within the range of color variation normal for *C. venosa*. With further study of more material from throughout the geographical distribution of this species, Mandl's named taxon may prove to predominate in certain populations; however, we are presently treating it as only an aberration and placing it in synonymy.

**Diagnosis.**—Distinguished by the elytral maculae fused laterally; long, sinuate middle elytral band with distal extension lying parallel to suture and almost reaching the apical lunule near sutural apex.

**Description.**—*General habitus.* Body small (8–9 mm); dorsum shiny green with copper reflections; elytra with complete and elongate lunules, all of which are connected laterally; body metallic copper-green to dark blue-green ventrally, however most of surface obscured by dense, decumbent, white setae. *Head.* Fourth male antennomere with a penicillum of clubbed bristles; apical mandibular tooth shorter than half of entire mandible length; labrum short and transverse, white with 8 to 12 submarginal setae and either lacking a medial tooth or with only a small, rounded bulge medially on each sex; frons, genae and vertex entirely glabrous except for two pairs of supraorbital setae; frons with numerous fine, longitudinal rugae extending onto vertex which is finely sculptured next to each eye and at middle; eyes flattened and bulging outward. *Prothorax.* Pronotum quadrate with obtuse outer apical angles, surface finely sculptured with shallow and narrow transverse sulci; laterally very long, sparse white setae originate from several irregular rows near margin, but extending more than halfway to middle; proepisterna with dense appressed setae which obscure the entire surface; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a deep, elongate cavity along posterior margin; mesepisterna and middle of metasternum glabrous, remaining sclerites completely covered by decumbent white setae. *Elytra.* Surface shiny copper with fine green punctures on most specimens, black with noncontrasting black-green punctures on some specimens; maculae white comprised of complete humeral and apical lunules (both ends of the latter projecting basally) and sinuate middle band (distal portion of which parallels suture toward apex), all lunules connected laterally by a thin white line which is much narrowed just before apical lunule, but not divided; elytral epipleura testaceous; microsculptulations small; apical margins abruptly and separately rounded, more curved on female than male; sutural spine prominent. *Abdomen.* Anterior five sterna on female and all sterna on male, entirely covered laterally by decumbent white setae, medially with only a few hairs. *Legs.* Trochanters metallic blue-green, one subapical seta on each front and middle segment; femora, and tibiae metallic copper and green; tarsomeres purple and green. *Male genitalia.* Aedeagus moderately stout, gradually enlarged on basal quarter and nearly of uniform width on middle half before tapering abruptly on apical quarter to a broadly truncate apex with a small, rounded, semisclerotized beak on the right; a wide longitudinal and slightly sinuate sclerotized flange extends basad from apex creating a broad concavity on apical quarter in left and right lateral aspects.

**Distribution.**—(Fig. 60). Occurs throughout the Indian subcontinent (except for peninsular India, Sri Lanka and Nepal) eastward into Southeast Asia.

**Localities.**—PAKISTAN: Lahore, islet in Ravi River, 13.VII.1975 (FCC, CMNH). INDIA: West Bengal: Rajmahal, 5.VII.09, abundant on muddy banks of Ganges River, and at lights on banks of Ganges River (DEI); Siliguri, 26.V.1956 (CMNH); Uttar Pradesh: Bijnor, 11.VII.1982, river sand bar (DLPC); Hardwar, 10.VII.1982, river sand bar (DLPC); Saharanpur, 9.VII.1982, river sand bar (DLPC); Haryana: Sultanpur, 4.VII.1982, pond edge (DLPC); 10 km S Chandigarh, 15.VII.1982, river sand bar (DLPC, CMNH); Union Territory: Chandigarh, 15.VII.1982, pond edge (DLPC); Chandigarh, 15.VII.1982, river sand bar (DLPC); New Delhi, IARI, 15.IX.1968, field of cowpeas (NMNH, CMNH); Punjab: 17 km N Rajpura, 27.VII.1982, river sand bar (DLPC); Assam: Gauhati, 55 m, 27.IV.1985 and 12.V.1985 (DLPC); 25 km S Dibrugarh, 1.V.1985 (DLPC); Gujarat: Sidhpur, Saraswati, 30.IX.1984 (DLPC). BANGLADESH: Dinajpur District: Dhanjuri, 1963 (CMNH). NEPAL: Sauraha, 28.V.1986, sandy river bank (DLPC); Gajuritar, 520 m, 20.V.1984 (RNC, CMNH); Rapti River at Merghauli, II.1973 (CMNH); Bagmati River N Chowbar Gorge, VIII.1971 (CMNH); Chitwan District: Chitwan Road at Lothar River, IX.1971 (CMNH). A specimen! with "Madras, Schröder" (DEI) probably is labelled incorrectly.

**Ecology.**—Adults are found at the margins of rivers, lakes and ponds with sandy substrate and little or no vegetation; also, they are attracted to lights. Naviaux (1985) reported the presence of this species in great numbers on wet, muddy sand banks with *C. (Eugrapha) grammophora* and *C. (Eugrapha) minuta*.

*Cicindela (Eugrapha) grammophora* Chaudoir

*Cicindela grammophora* Chaudoir, 1852:7.

*Type status.* Syntypes [description based on an unspecified number of females (no males available); unexamined; concept based on comparing its original description with specimens! labelled "India, New Delhi, 28.V.1968", at CMNH]. *Type depository.* ?MNHN. *Type locality.* "Hindustan" (northern India).

*Cicindela grammophora* Chaudoir: Fowler, 1912:363, fig. 157.

*Cylindera (Eugrapha) grammophora* (Chaudoir): Rivalier, 1961:143.

*Cylindera (Eugrapha) grammophora* (Chaudoir): Naviaux, 1985:74, fig. 30, 64, 94.

*Diagnosis.*—Distinguished by the elytral humeral lunule and middle band are separated from each other; humeral lunule long, reaching to middle of elytral disc, and ending in a bulge.

*Description.*—*General habitus.* Body small (8–8.5 mm); head and pronotum dull green with copper reflections; elytra dark, green reflections basally; standard pattern of complete maculae separated laterally; body ventrally metallic dark green, mostly obscured by decumbent white setae. *Head.* Fourth male antennomere lacking a penicillum of clubbed bristles; apical mandibular tooth shorter than half of mandible length; labrum short and transverse, white with eight to ten submarginal setae and a minute medial tooth on each sex; frons with numerous fine, longitudinal rugae extending onto vertex where they become transverse at middle; eight to ten mostly complete large rugae between each eye and vertex midline; eyes slightly bulging outward; frons, genae and vertex entirely glabrous. *Prothorax.* Pronotum quadrate with obtuse outer apical angles, surface finely sculptured with shallow and narrow transverse sulci and a short medial line, laterally with very short, sparse white setae originating from several irregular rows near margin and halfway toward middle; proepisterna with dense appressed setae obscuring most of the surface except for a narrow smooth glabrous dorsal area; prosternum with numerous fine hairs. *Pterothorax.* Female mesepisternal coupling sulcus a narrow medial groove, deepest posteriorly; pleura and sterna, except for mesepisterna and middle of metasternum, covered by white, decumbent setae. *Elytra.* Dense blue punctures on colored surface; white maculae comprising complete and separate humeral and apical lunules (apical end of the former and basal end of the latter dilated into a stalked spot medially); middle band extended at the lateral margin both basally and apically and dilated where transverse portion turns apically; elytral epipleura testaceous; apices microserulate, margins evenly rounded; small sutural spine. *Abdomen.* Anterior five sterna on female and all sterna on male, nearly covered laterally by decumbent white setae, medially with only a few hairs. *Legs.* Trochanters nonmetallic dark brown, rear pair slightly metallic blue-green tinged, one subapical seta on each front and middle segment; femora and tibiae metallic purple and green; tarsomeres purple. *Male genitalia.* Aedeagus moderately stout, gradually enlarged on basal quarter and nearly of uniform width on middle half before tapering abruptly on apical quarter to a broadly truncated apex with a small, rounded, lightly sclerotized beak on the right separated from apical orifice by a membranous notch; wide longitudinal and slightly sinuate sclerotized flange extending basad from apex creating a broad concavity on left and right lateral aspects adjacent to apical orifice.

*Distribution.*—(Fig. 60). Northeast Pakistan, northern India (Punjab, Rajasthan, Haryana, Uttar Pradesh, Bihar, West Bengal, Orissa), Nepal, and Bangladesh.

*Localities.*—INDIA: Union Territory: New Delhi, IARI, 28.V.1968, light trap (NMNH, CMNH); New Delhi, 28.VII.1983, night light (DLPC); Chandigarh, 26.VII.1982, grassland (DPLC); Chandigarh, 15.VII.1982, river sand bar (DLPC, CMNH); Chandigarh, 15.VII.1982, pond edge (DPLC); Punjab: 17 km N Rajpura, 27.VII.1982, grassland (DLPC); Haryana: 10 km N Chandigarh, 16.VII.1982, river sand bar (DLPC); 10 km S Chandigarh, 26.VII.1982, grassland (DPLC); Uttar Pradesh: Hardwar, 10.VII.1982, river sand bar (DLPC); Muzaffarnagar, 8.VII.1982, forest path (DLPC); 20 km NE Saharanpur, 28.VI.1983, sandy river beach (DLPC). NEPAL: Sauraha, 200 m, 19.V.1984 (RNC, CMNH); Sapt Kosi, 110 m, 15.V.1984 (RNC, CMNH).

*Ecology.*—Adults occur on wet, open muddy areas with little or no vegetation. Fowler (1912) reported it common on the banks of the River Ganges where it was attracted to lights. Naviaux (1985) found this species in large numbers around pools of water near rivers.

*Cicindela (Eugrapha) singalensis* Horn

*Cicindela dissimilis singalensis* Horn, 1911:53.

*Type status.* Holotype, female! *Type labels.* "Hambantota, Ceylon S.P., T.B.T. IX.21" [handscript]; "Type, Dr. W Horn" [typeset]; "Holotypus" [typeset red label]; "Cicindela, singalensis W. Horn, seen by R.E. Acciavatti, 1985" [typeset]. *Type depository.* Holotype at DEI. *Type locality.* "Hambantota, Ceylon" (Sri Lanka).

*Cylindera (Eugrapha) dissimilis singalensis* (Horn): Rivalier, 1961:143.

*Cylindera (Eugrapha) singalensis* (Horn): Naviaux, 1986:59, fig. 4-7.

*Diagnosis.*—Distinguished by the glabrous genae and clypeus; macula absent from humeral elytral angle.

*Description.*—*General habitus.* Body small (8–8.5 mm); dorsum shiny bronze-green; elytra with a standard pattern of maculae, but humeral lunule absent from humeral angle, middle band very sinuate and divided into blotches, marginal band often expanded at base and nearly touches apical lunule; body metallic bronze-green ventrally. *Head.* Antennal scape with one subapical seta; labrum short, whitish testaceous with six to eight submarginal setae and one acute medial tooth; clypeus, frons and genae glabrous; 15 to 17 mostly complete moderately raised rugae between each eye and vertex midline, many rugae extending behind eye and onto frons laterally; eyes not prominent. *Prothorax.* Pronotal disc glabrous, covered by moderately impressed, irregular pattern of rugae extending onto wide anterior reflexed margin but nearly absent at middle of narrow posterior reflexed margin; transverse sulci shallowly impressed; pronotum laterally with numerous very long appressed setae which originate from five very irregular rows of moderately large setigerous punctures, and extend halfway toward middle of disc; proepisterna dorsally with a rough pattern of wavy wrinkles and ventrally with numerous long, appressed setae which extend over ventral three-quarters of the surface; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a narrow posterodorsal groove with small depression at lower end; mesepisterna sparsely setose on ventral half; remaining pleura and sterna mostly covered by long, white appressed setae which obscure surface in places. *Elytra.* Surface covered with small, dense and moderately deep iridescent green, blue and purple punctures; interpunctural space shiny copper; maculae with irregular margins and varied in shape; basal portion of humeral lunule absent, apical lunule complete, middle band very sinuate with mesal and distal portions divided into irregular blotches and expanded apically near suture and along marginal line apically, on some specimens marginal line extends basally to join humeral lunule; elytral epipleura pale, nonmetallic; apex micro-serrulate; small sutural spine more noticeably retracted on female than on male. *Abdomen.* Lateral surface of first five sterna with long, dense, white appressed setae extending over all but a narrow, glabrous medial area; laterally last sternum with only fine hairs on female, but with long setae on male. *Legs.* Trochanters reddish testaceous, slightly green tinged, one subapical seta on each front segment, each middle segment glabrous; femora, tibiae and tarsomeres metallic green to blue-green. *Male genitalia.* Aedeagus moderately stout, gradually enlarged on basal third and nearly of uniform width on apical two-thirds before tapering abruptly to a blunt apex with a long and rounded, semisclerotized beak on the right slightly tilted to the left; sclerotized flange near apex wide, slightly sinuate extending basad and creating a broad concavity on most of left and right lateral aspects adjacent to apical orifice.

*Geographic variation.*—The majority of specimens! from southeastern Tamil Nadu, India, have a marginal line of the middle band extending basally to join the humeral lunule, whereas in the Sri Lanka specimens! the anterior extension of the marginal line is short or absent.

*Distribution.*—(Fig. 60). Sri Lanka and primarily in adjacent southern India (Tamil Nadu). Specimens! from Bihar and Rajasthan, India, may indicate a wider but sporadic distribution throughout more of India than previously thought.

*Localities.*—INDIA: Tamil Nadu: Thanjavur District, Vedaranyam, X.1982, sea level, open sand  $\frac{1}{2}$  km inland (CMNH); Point Calimere, sea level, 20.X.1987, ocean beach (DLPC); Bihar (IARI); Rajasthan: Lake Sambhar, 17.VIII.1987 (KWC). SRI LANKA: Hambantota District: Hambantota, IX.1921 (DEI).

*Ecology.*—Adults are found in dry, open sandy habitats near the Indian seacoast (T. R. S. Nathan, personal communication, 1984), along major rivers and around

inland lakes from August to November. Naviaux (1986) reported its presence in flat, muddy open places near the sea in extreme southern Sri Lanka.

*Remarks.*—Walther Horn's subspecific ranking of *Cicindela (Eugrapha) singalensis* under *Cicindela (Eugrapha) dissimilis* Péringuey, 1893:50, from the Ethiopian biogeographic region, is incorrect. By comparing the holotype of *Cicindela singalensis* with four syntypes! of *C. dissimilis*, all of DEI, we agree with Naviaux (1986) that *C. singalensis* represents a separate species.

In addition to the wide geographic separation and differences of elytral maculae mentioned by Naviaux (1986), we base our conclusion about the distinctiveness of these two species on several additional morphological differences. *Cicindela singalensis* in comparison with *C. dissimilis* has the following characters: 1) female mesepisternal coupling sulcus a narrow groove with small, shallow depression at ventral end compared to mesepisternal groove deepest dorsally; 2) proepisterna rough and wrinkled with sparse appressed setae compared to proepisterna smooth and glabrous on dorsal half; 3) middle trochanters lack subapical setae compared to each having a seta.

### *Cicindela (Eugrapha) sublacerata* Solsky

*Cicindela sublacerata* Solsky, 1874:8.

*Type status.* Lectotype, female [here designated]. *Type labels.* "Type" [handscript on label with golden marks at bottom edge]; "ex coll, Dr. Richter" [typeset lines within thin black marginal line]; "Type!, coll. W Horn" [same as previous]; "Syntypus" [typeset on red label]; "Coll. DEI, Eberswalde" [typeset lines], "LECTOTYPE, *Cicindela, sublacerata* Solsky, by R.E. Acciavatti, '85" [typed and handprinted red label]. [Lectotype is 9 mm; missing right front leg.] Paralectotype, female! [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository.* Lectotype and paralectotype at DEI. *Type locality.* "Kokan" (Kokand, Uzbek S.S.R., U.S.S.R.).

*Cicindela balucha* Bates, 1878b:332.

*Type status.* Holotype female [by monotypy; unexamined; concept based on comparing its description with a specimen! labelled "Pakistan, Baluchistan, Quetta, 12.VII.1956", at CMNH]. *Type depository.* ?MNHN. *Type locality.* "Beloochistan" (Baluchistan, Pakistan).

*Cicindela sublacerata* Solsky: Fowler, 1912:368.

*Cylindera (Eugrapha) sublacerata balucha* (Bates): Rivalier, 1961:143.

*Diagnosis.*—Distinguished by the setose genae and clypeus.

*Description.*—*General habitus.* Body very small to small (7.5–8 mm); head and pronotum shiny, varied from green to copper-green to copper and covered with sparse semierect setae; elytra dull (most specimens slightly shiny basally) green to copper-green with numerous contrasting purple or blue-green punctures; elytral maculae standard pattern but divided; middle band sinuate often divided into pieces apically, lunules on most specimens separate (on some specimens all joined at lateral margin); body ventrally dark purple-black with golden copper reflections. *Head.* Antennal scape with one subapical seta, proximal five segments metallic copper-green, distal six segments reddish testaceous; fourth male antennomere lacking a penicillum; terminal segments of labial and maxillary palpi almost all metallic copper-green, remaining segments testaceous; labrum short whitish; medial carina absent; small acute medial tooth on each sex; four to nine submarginal setae; genae, clypeus, frons and vertex covered with sparse semierect setae; eyes prominent; vertex deeply excavated; 10 to 15 mostly complete, strongly raised, longitudinal rugae between each eye and middle with rugae extending onto frons, but feebly raised and irregular rugae behind eyes creating a granulate appearance. *Prothorax.* Pronotum covered with sparse semierect setae on disc and denser more decumbent setae originating from several irregular rows of small setigerous punctures on lateral and anterior margins, posterior margin setose only at sides; surface with moderately raised, wavy and irregular rugae; anterior and posterior transverse sulci moderately impressed; proepisterna copper with parallel shallow impressions dorsally becoming indistinct toward center with setae decumbent at center, sparse dorsally, abundant ventrally, long and erect on deeply impressed posterior and anterior margins; prosternum at most with one or two setae anterior to coxae. *Pterothorax.* Female mesepisterna glabrous except on posteroventral margin; cou-

pling sulcus a very broad medial groove and deeper elongate depression dorsally above middle; remaining sclerites covered by dense decumbent setae nearly obscuring golden copper-green color on lateral surfaces. *Elytra*. Surface moderately granulate-punctate with dense, moderately impressed, large purple to blue-green punctures; punctures and granules deepest basally, shallow to nearly impunctate apically; maculae yellowish-white consisting of complete humeral and apical lunules with smooth edges; middle band sinuate and complete for part of its length, transverse portion curved basally then abruptly recurved apically, discal portion divided into small irregular shapes, extreme apical end nearly touching sutural ridge; marginal band long, anterior segment shorter than posterior segment; lunules on some specimens narrowly fused, on other specimens broadly fused, along lateral margin; wide lateral expansion along female elytral margin creating subovate shape; male elytra subparallel; elytral epipleura pale, nonmetallic; apex microserulate; short sutural spine on each sex, slightly retracted from a rounded margin on female, but not retracted from a truncated margin on male. *Abdomen*. Sterna with abundant decumbent setae laterally and fine hairs on center of all but last sternum. *Legs*. Trochanters reddish purple or reddish testaceous, slightly metallic tinge; one subapical seta on each front and middle each segment; femora metallic blue-green and purple to blue-green to copper; tibiae reddish testaceous on proximal half becoming metallic blue-green at distal end; tarsomeres purple. *Male genitalia*. Aedeagus stout, widest on middle third, tapering to a broad, uniformly rounded apex with a small, rounded beak on right; subapical flange absent from either lateral aspect.

*Geographic variation*.—We recognize two subspecies of *Cicindela sublacerata*: nominal *C. sublacerata* is greenish dorsally with separate lunules (a few specimens with copper head and pronotum have green to copper-green elytra and humeral lunule separated from or narrowly joined to apical expansion of the marginal band), femora metallic blue-green and purple; *C. sublacerata balucha* has the dorsal color copper to copper-green with the elytral maculae expanded marginally so that marginal line joins narrowly or fuses broadly with both the anterior and posterior lunules, femora metallic blue-green to copper color.

*Distribution*.—(Fig. 59). Nominal *Cicindela sublacerata sublacerata* occurs throughout the southern republics of the Soviet Union (Turkmen, Uzbek, Tadzhik, Kirghiz), and adjoining portions of Iran, Afghanistan, the Sinkiang Uighur Autonomous region of China. On the Indian subcontinent, it has been found only in extreme northern Pakistan and India (Jammu and Kashmir); *Cicindela sublacerata balucha* is found in Pakistan (Baluchistan) and adjoining parts of Iran and Afghanistan.

*Localities*.—*Cicindela sublacerata sublacerata*. U.S.S.R.: Uzbek S.S.R.: Samarkand (DEI); Buchara (Bukhara) (DEI); Kirghiz S.S.R.: Mursarabat; Tschardjui (?Tschatkatl Mts., Kirghiz S.S.R.), 10.VI.1904 (DEI); Tedschan (?Tien Schan Mountains, Kirghiz S.S.R.), V,VI.1905 (DEI); Turkmen S.S.R.: Jagnob, Ravat (DEI). CHINA: Sinkiang Uighur Autonomous Region: Takla Makan (Desert) (DEI). PERSIA (IRAN) (DEI). Reported by Mandl and Piffel (1961) from Gilgit, Jammu and Kashmir, India. *Cicindela sublacerata balucha*. PAKISTAN: Perso-Baluch Frontier (DEI); Baluchistan: Quetta, 12.VIII.58 (CMNH).

*Ecology*.—The habitat of this species is unreported but adults are most likely associated with open sandy habitats near water. From label data examined, adults of this species appear during the spring and midsummer.

### Subgenus *Cicindela* (*Eriodera*) Rivalier

*Cylindera* (*Eriodera*) Rivalier, 1961:143.

Type species.—*Cicindela albopunctata* Chaudoir, 1852.

*Diagnosis*.—The following characters distinguish *Cicindela* (*Eriodera*) species adults from those of related subgenera: 1) flagellum of male genitalic internal sac slender coiled in the left lateral aspect without sustained membranes but accompanied by a small basal plate as for *Cicindela* (*Cylindera*); 2) a standard but divided pattern of elytral maculae characterized by a lateral spot posterior to middle band



as for subgenus *Cicindela* (*Lophyridia*); 3) dense appressed setae on the head, pronotum and ventrally on all pleura and sterna giving the entire body a tomentose appearance; 4) femora with numerous hooked setae.

*Included species.*—A monotypic subgenus, *Cicindela* (*Eriodera*) is restricted to the northern portions of the Indian subcontinent and contains: *C. (E.) albopunctata* Chaudoir, 1852.

***Cicindela (Eriodera) albopunctata* Chaudoir**

*Cicindela albopunctata* Chaudoir, 1852:10.

*Type status.* Lectotype, male [here designated]. *Type labels.* "182" [typeset]; "albopunctata, Chaud.\*, Ind. or. Chaud." [three manuscript lines on large yellow label with thin black marginal line]; "LECTOTYPE, *Cicindela*, albopunctata Chaudoir, by R.E. Acciavatti, '84" [typed and hand printed red label]. [Lectotype is 10.5 mm; genitalia and right antenna missing; large hole in right elytron from previous pin; pronotum glued to body.] [Chaudoir described this species from three syntypes of both sexes; we believe the lectotype originated from these specimens as presented to us by MNHB; the other syntypes may be at MNHNP.] *Type depository.* Lectotype at MNHB. *Type locality.* "Environs de Simlah" (Simla, Himachal Pradesh, India).

*Cicindela olivia* Bates, 1878b:330.

*Type status.* Syntypes [three males referenced in original description; unexamined; concept based on male! at BMNH determined by Bates; labelled "Ind. Or." (handscript); "Oliviae, Arm: Bates" (handprinted); "1902-134, Named passed by, Dr. W. Horn, in Coll. F. Bates." (typeset); "*Cicindela*, albopunctata Chaudoir, det. R.E. Acciavatti, 1985" (typeset).] *Type depository.* MNHNP. *Type locality.* "Chamusuri and Moradabad, India."

*Cylindera (Eriodera) albopunctata* (Chaudoir): Rivalier, 1961:143.

*Cicindela funerea eberti* Mandl, 1965:72, new synonymy.

*Type status.* Holotype, female! [by original designation]. *Type labels.* "NEPAL, Likhu Khola Tal, 1700 m, 4.VI.62, leg. G. Ebert" [all but 'VI' typeset]; "Holo-Typus, *Cicindela funerea*, ssp. eberti m., 1964, det. Dr. K. Mandl" [all handprinted except 'Typus' and last line which are typeset on one-sided orange label]; "Cic. funerea, ssp. eberti m" [handscript]; "*Cicindela (Eriodera)*, albopunctata, Chaudoir, det. R.E. Acciavatti, 1988" [handprinted and typed label]. [Holotype is 11 mm; body glued to paper.] *Type depository.* Holotype at ZSBS. *Type locality.* "Likhu Khola Tal, Nepal."

*Cylindera (Eriodera) albopunctata* (Chaudoir): Naviaux, 1985:80, fig. 34, 68, 99.

*Description.*—*General habitus.* Body medium (10–11 mm); dorsum olive green to dull brown-green with slight metallic copper reflections; most of body sclerites with long appressed and erect setae; divided pattern of elytral maculae; body ventrally greenish blue, nearly covered with dense appressed setae. *Head.* Labrum short, widened medially, testaceous with dark anterior and lateral margins, one medial tooth and 12 to 16 setae in irregular submarginal rows; long appressed setae laterally on clypeus, above antennal insertion on frons and covering genae; eyes prominent, bulging dorsally; vertex with slightly raised longitudinal rugae near eyes becoming wavy at middle. *Prothorax.* Entire pronotal surface with long appressed setae appearing tomentose; mesepisterna copper-green with appressed setae over entire medial surface, anterior and posterior margins with long erect setae; prosternal setae abundant and erect. *Pterothorax.* Female mesepisternal coupling sulcus a broad, shallow groove; entire ventral surface except medial part of metasternum covered with long, appressed setae. *Elytra.* Shiny olive-green to brown, shallowly and densely granulate-punctate with wide, blue punctures which often coalesce, maculae consisting of a divided humeral lunule with anterior portion confined to lateral margin and apical end widely separated forming a separate oval spot on disc basally, a divided middle band with medial portion widely separated forming a separate oval spot on disc medially, a short elongate lateral spot representing marginal band widely separated from lateral portion of middle band and complete apical lunule expanded at basal end; apex microserulate, margin broadly rounded with a small sutural spine on each sex. *Abdomen.* Covered with long, appressed setae laterally and shorter appressed setae medially. *Legs.* Trochanters metallic blue-green, one subapical seta on each front and middle segment; femora metallic copper-green; numerous hooked setae along posterior margins of front and middle pairs of femora for three-quarters of their length; tibia copper, green and purple; tarsomeres purple-green. *Male genitalia.* Aedeagus small, stout, enlarging gradually to maximum width on apical third just before apex, abruptly tapering to a large, blunt tip at the right; subapical flange



originating near apex, moderately raised and sinuate at base, creating a broad concavity extending basally for one-third of the entire aedeagal length.

**Distribution.** —(Fig. 60). Northern India (Punjab, Uttar Pradesh, Himachal Pradesh, West Bengal, Sikkim, Assam), Nepal and Bhutan.

**Localities.** —INDIA: Punjab: 24.VII.1922 (CMNH); Uttar Pradesh: 20 km N Dehra Dun, 9.VII.1982, rocky river side (DLPC); Himachal Pradesh: 10 km S Solon, 18.VII.1982, rocky creek bed (DLPC); 20 km N Kalka, 26.VI.1983, rocky river side and rocky creek bed (DLPC); Kasani, 4000 m, 1970 (DLPC); West Bengal: Kurseong (BMNH). SIKKIM (BMNH). NEPAL: Sildhunga, 33 km W Jiri, 925 to 1230 m, 20.IX.1971 (CMNH).

**Ecology.** —Adults frequent the margins and exposed beds of mountain water-courses where they occur most commonly on bare rocks and boulders. Naviaux (1985) mentioned their attraction to lights.

### Subgenus *Cicindela* (*Monelica*) Rivalier

*Myriochile* (*Monelica*) Rivalier, 1950:235.

Type species. —*Cicindela fastidiosa* Dejean, 1825.

**Diagnosis.** —Adults of the single *Cicindela* (*Monelica*) species occurring on the Indian subcontinent are distinguished from those of other subgenera by the following characters: 1) male genitalic internal sac with a flagellum coiled tightly to form 1½ to 2 concentric spirals which are only partially visible in the left lateral aspect as they are enclosed within a membranous disc; 2) labrum short, testaceous with four submarginal setae; 3) completely to partly testaceous legs, proximal end of tibiae paler than distal ends of femora (on most specimens paler than entire length of femora); 4) femora with sparse hooked setae along entire posterior margin; 5) standard elytral pattern of maculae fused completely or nearly so along lateral margin; 6) female elytral disc medially on basal third lacking a shiny area on most specimens, a few specimens with only a diffused, slightly shiny area.

**Included species.** —*Cicindela* (*Monelica*) has numerous species in the Ethiopian and Palearctic biogeographic regions; however, only *C. (M.) fastidiosa* Dejean, 1825 is found on the Indian subcontinent.

### *Cicindela* (*Monelica*) *fastidiosa* Dejean

*Cicindela fastidiosa* Dejean, 1825:95.

Type status. Syntype(s)? [unexamined; concept based on specimens! from India, Pondicherry, Karaikal, X.1986, at CMNH]. Type depository. ?MNHN. Type locality. "Indes Oriental."

*Cicindela litigiosa* Dejean, 1825:97.

Type status. Syntype(s)? [unexamined; synonymy follows Horn (1926)]. Type depository. ?MNHN. Type locality. "Indes Oriental."

*Cicindela leucoloma* Chaudoir, 1852:12.

Type status. Syntypes [unspecified number of each sex; unexamined; concept based on a specimen! from India, Haryana, Sultanpur, 4.VII.1982, pond edge, at DLPC]. Type depository. ?MNHN. Type locality. "Simla" (Uttar Pradesh, India).

*Cicindela despecta* Fleutiaux, 1886a:88.

Type status. Syntypes [described from two males; unexamined; synonymy follows Horn (1926) who indicated one syntype represented another species, most likely *C. atelesta* Chaudoir]. Type depository. ?MNHN. Type locality. "Indes Orientales Boreales."

*Cicindela leucoloma* Chaudoir: Fowler, 1912:352, fig. 154.

*Cicindela fastidiosa leucoloma* Chaudoir: Horn, 1926:172.

*Myriochile (Monelica) fastidiosa* (Dejean): Rivalier, 1961:144.

*Myriochile (Monelica) fastidiosa* (Dejean): Naviaux, 1984b:71, fig. 47–49.

**Nomenclatural note.**—The synonymy presented here is only provisional for several reasons. This species is varied throughout its geographic distribution in many characters and habitat preference (see discussions under geographic variation and ecology below) suggesting that more than one species is present within our concept; however, a thorough study of large samples from numerous populations would be needed to verify this suggestion. Because the original descriptions are vague or lacking in the characters we consider relevant for species differentiation, the appropriate names to apply to our concepts require studying syntypes of the various named taxa, none of which were available.

**Description.**—**General habitus.** Body small to medium (8–10 mm); head and pronotum shiny blue-green or copper, the latter finely rugose; elytra dull greenish bronze to copper (on some specimens blue to blue-green); standard pattern of elytral maculae although pattern varied from narrowed and separate on some specimens to broad and fused on other specimens; body ventrally copper on thorax, greenish blue on abdomen. **Head.** Short smooth ivory labrum; four to six submarginal setae, three small, acute teeth (middle largest) on female, one small acute medial tooth on male; frons with fine longitudinal rugae which extend onto vertex where they become coarser adjacent to each eye but medially form a finely pebbled surface; frons, vertex and genae entirely glabrous; mandibles symmetrical with four teeth distad basal molar; last segment of labial and maxillary palpi dark metallic blue-green. **Prothorax.** Pronotum subquadrate with sides parallel; pronotum with moderately abundant, appressed white setae in several irregular rows laterally and at anterior and posterior margins; pronotal surface covered with a moderately coarse, raised reticulated network; posterior transverse pronotal sulcus shallowly depressed near lateral posterior angle and at middle; proepisterna with coarse, parallel and irregular raised areas especially dorsally, completely covered by semierect setae; prosternum with erect setae laterally. **Pterothorax.** Female mesepisternal coupling sulcus a narrow and slightly posteroventrally slanting groove, deepest at or below middle, surface anterior to groove smooth and glabrous on female, glabrous and slightly wrinkled on male; remaining pleura and sterna covered with moderately dense appressed setae. **Elytra.** Elytral surface with blue-green punctures; maculae varied; on most specimens as separate and complete humeral and apical lunules and a middle band with a lateral expansion both basally and apically, often mesal end of humeral lunule separated as a spot; on some specimens all lunules joined by a continuous marginal band; elytral epipleura testaceous; elytral apices microserulate, margins on each sex separately rounded with a short, sutural spine. **Abdomen.** Sterna covered with dense, semierect setae except medially where fine erect hairs dominate. **Legs.** Trochanters testaceous, semitranslucent, one subapical seta on each front and middle segment; femora with hooked setae along entire posterior margin; femora, tibiae and tarsomeres varied, some specimens almost totally pale testaceous, other specimens metallic green; tarsal claws small. **Male genitalia.** Aedeagus moderately slender, gradually widening on basal half, widest at middle and gradually tapering on apical half before abruptly ending in a small truncated apex with a small, rounded, lightly sclerotized beak on the right; subapical flange short and small, situated in both left and right aspects medially below distal end of apical orifice.

**Geographic variation.**—We presently recognize two subspecies of *Cicindela fastidiosa*: for adults of *C. fastidiosa fastidiosa* elytral lunules separate and distinct, some or all of which may be divided into spots, femora and tibiae on most specimens only partially metallic, on other specimens majority of these segments translucent testaceous; for adults of *Cicindela fastidiosa leucoloma* all lunules joined by a continuous band laterally along the elytra, femora and tibiae pale testaceous.

**Distribution.**—(Fig. 62). Nominal *Cicindela fastidiosa* is widely distributed from Pakistan throughout India and Sri Lanka to Burma, whereas *C. fastidiosa leucoloma* occurs in Himachal Pradesh, Punjab, Haryana, and Uttar Pradesh, India, and Nepal.

**Localities.**—*Cicindela fastidiosa fastidiosa*. INDIA: Tamil Nadu: Madurai, 14.XI.1984 (DLPC); Coimbatore, X.1956 (CMNH); Pudukkottai District, Pudukkottai, XI.1984 (CMNH); Tope, 350 m,

21.IX.1986, scrub forest (DLPC); Union Territory: Pondicherry, Karikal, VIII.1988, sea level (CMNH); Karikal, IX.1983, sea level (CMNH); Karnataka: Bangalore, 12.V.1973 (DLPC); 15 km N Bangalore, 12.VI.1983, old field (DLPC); 15 km N Bangalore, 12.VI.1983, forest path (DLPC); 15 km E Tumkur, 29.VI.1984, scrub forest floor (DLPC); Jog Falls, 10.VI.1985, forest path (DLPC); 50 km E Jog Falls, 550 m, 10.VI.1987, grassland (DLPC); 5 km E Chintamani, 22.VII.1986, scrub forest (DLPC); Andhra Pradesh: 11 km W Narsipatnam, 28.VI.1986, scrub forest (DLPC); 15 km NW Waltair, brackish mud flat (CMNH); 57 km NW Hyderabad, 4.VII.1986, scrub forest (DLPC); Bihar: 17 km N Hazaribagh, 21.VI.1986, scrub forest (DLPC, CMNH); 65 km W Ranchi, 23.VI.1986, scrub forest (DLPC); Orissa: Simlipal National Park, 24, 25.VI.1986, scrub forest (DLPC); Uttar Pradesh: 20 km NW Dehra Dun, 30.VI.1983, forest path (DLPC). SRI LANKA: Wilpattu National Park, 24.XI.1980 (DLPC); Anuradhapura, 25.XI.1980 (DLPC); Tissamaharama, 31.X.1986 (CMNH). *Cicindela fastidiosa leucoloma*. INDIA: Haryana: Sultanpur, 4.VII.1982, pond edge (DLPC); Union Territory: New Delhi, 14.VI.1939, night light (DLPC); New Delhi, 16.VII.1935, night light (DLPC). NEPAL: Arun Valley, Sultibari, 500 m, 11–14.VI.1988 (JPC, CMNH).

*Ecology.*—Adults of *Cicindela fastidiosa leucoloma* occur on the edge of muddy ponds and lakes, whereas those of nominal *C. fastidiosa* frequent old fields, grasslands, forest paths and the floor of scrub forest. This different ecological preference of each subspecies suggests that each represents a species. Further studies of morphology and habitat preference of specimens from throughout this species' range would be needed to determine if the two subspecies belong to separate species. Naviaux (1984b) reported that adults are attracted to lights.

#### Subgenus *Cicindela* (*Myriochile*) Motschulsky

*Catoptria* Guérin-Méneville, 1849:146 (preoccupied, Hübner, [1825]1816:365).

Type species.—*Cicindela aegyptiaca* Dejean, 1825.

*Myriochile* Motschulsky, 1862:22.

Type species.—*Cicindela aegyptiaca* Dejean, 1825.

*Lutaria* Horn, 1891:5.

Type species.—*Cicindela melancholica* Fabricius, 1798.

*Myriochile* (*sensu stricto*) Motschulsky: Rivalier, 1950:234.

*Myriochile* (*sensu stricto*) Motschulsky: Rivalier, 1961:141.

*Nomenclatural note.*—Some uncertainty exists about the correct name for this subgenus and the authorship of its type species. When Motschulsky (1857:109) described *Myriochila dohrnii*, he indicated *Myriochila* was a new subgeneric name, provided distinguishing labral characters and listed four other included species. Under the Code (Article 56, ICZN, 1985) subgeneric names are to be treated the same as generic names, and names with one letter differences are not homonyms. Thus, *Myriochila* is senior to *Myriochile*; however, this senior generic name was treated differently by Horn (1926) who did not ascribe its publication to Motschulsky but to himself in 1905. Jeannel (1946) was the first to clearly define *Cicindela* (*Myriochile*) (*sensu* Motschulsky), and in the interest of nomenclatural stability (Article 24, ICZN, 1985) we also recognize *Myriochile* in place of *Myriochila* for this subgenus.

The correct authorship for the type species of *Cicindela* (*Myriochile*), *Cicindela aegyptiaca*, also has to be clarified. Dejean (1825:96) described this species but ascribed it to Klug who proposed it *in litteris*. Horn (1926:138) apparently recognized this, gave Dejean the authorship for *C. aegyptiaca*, and considered it a junior synonym of *C. melancholica* Fabricius.

*Diagnosis.*—*Cicindela* (*Myriochile*) species adults differ from those of other subgenera on the Indian subcontinent by: 1) male genitalic flagellum coiled tightly

to form  $3\frac{1}{2}$  to 5 concentric spirals; flagellum is only partially visible in the left lateral aspect because it lies in a sagittal plane enclosed within a membranous disc; 2) labrum short, testaceous with four submarginal setae; 3) femora with hooked setae along entire posterior margin; 4) completely metallic legs; 5) pattern of elytra maculae standard but varied; comprised of divided humeral lunule (on some species reduced or absent), middle band (on some species extended along lateral margin) and apical lunule; 6) body ventrally with moderately abundant appressed setae; 7) female elytral disc of certain species with smooth, polished shiny area evident medially on basal third.

*Included species.*—The following species of *Cicindela* (*Myriochile*) occur on the Indian subcontinent: *C. (M.) melancholica* Fabricius, 1798; *C. (M.) undulata* Dejean, 1825; *C. (M.) dubia* Horn, 1892, new rank; *C. (M.) atelesta* Chaudoir, 1854; *C. (M.) distinguenda* Dejean, 1825.

#### Key to adults of *Cicindela* (*Myriochile*) species

1. Elytral humeral lunule with basal portion reduced to a small dot or entirely absent ..... 2
  - Elytral humeral lunule with basal portion elongate although it may be separated from or joined to apical end ..... 3
- 2.(1) Labrum unidentate on male, tridentate on female; female elytra with a slightly shiny area medially on disc on basal third .... *undulata* Dejean
  - Labrum tridentate on both sexes; female elytra without a slightly shiny area on basal third ..... *atelesta* Chaudoir
- 3.(1) Humeral elytral lunule complete, apical end not reaching middle of elytra ..... *dubia* Horn, new rank
  - Humeral elytral lunule divided, apical spot located at middle of elytra on some specimens, humeral lunule complete and broadly joined to lateral expansion of middle band on other specimens ..... 4
- 4.(3) Rear trochanters nonmetallic, testaceous ..... *melancholica* Fabricius
  - Rear trochanters metallic, violet to green-black or reddish ..... *distinguenda* Dejean

#### *Cicindela* (*Myriochile*) *melancholica* Fabricius

*Cicindela melancholica* Fabricius, 1798:63.

*Type status.* Lectotype, male [here designated]. *Type labels.* [Small green square], “Type” [typed red label]; “Guinea, Meier, Mus: T: Lund., *Cicindela melancholica* F.” [handscript]; “Zool. Museum, DK Copenhagen” [typeset]; “LECTOTYPE, *Cicindela, melancholica* Fabr., by R.E. Acciavatti, '83” [typed and handprinted red label]. [Lectotype is 9.5 mm; previously pinned through the pronotum before pin moved to right elytron.] Paralectotype, male! [here designated] labelled “PARALECTOTYPE” [typed and handprinted red label]. *Type depository.* Lectotype and paralectotype at ZMUC. *Type locality.* “Guinea.”

*Myriochile* (*sensu stricto*) *melancholica* (Fabricius): Rivalier, 1961:144.

*Myriochile* (*sensu stricto*) *melancholica* (Fabricius): Naviaux, 1983:82, fig. 18, 45, 68.

*Diagnosis.*—Distinguished by the humeral lunule (divided on some specimens, complete on others) extending to middle of elytral disc; large shiny spot on female elytral disc; nonmetallic reddish testaceous trochanters.

*Description.*—*General habitus.* Body small to medium (9.5–10 mm); head, pronotum and elytra dull greenish with copper reflections; narrowed or divided pattern of elytral maculae; body metallic copper-green ventrally. *Head.* Labrum testaceous, short; four submarginal setae, three acute teeth (middle largest) on female, one small acute medial tooth on male; frons with fine longitudinal rugae extending onto vertex; rugae moderately deep adjacent to each eye, rugae on vertex forming a very fine pebbled surface medially; frons, vertex and genae glabrous; mandibles with four long teeth distad

basal molar, mandibles of female asymmetrical with second tooth on left mandible much larger than corresponding one on right mandible, mandibles of male symmetrical; last segment of labial and maxillary palpi metallic green. *Prothorax*. Pronotum subquadrate with sides parallel on male, nearly so on female; pronotum with sparse appressed setae in one or two irregular rows laterally and at anterior and posterior margins; pronotal surface covered with a moderately raised pebbled surface; transverse sulci of pronotum moderately impressed; proepisterna completely covered with appressed setae; prosternum with erect setae laterally. *Pterothorax*. Female mesepisternal coupling sulcus a narrow, slightly posteroventrally slanting groove, deepest basally, surface anterior to groove smooth and glabrous on female, sparsely setose and slightly wrinkled on male; remaining pleura and sterna covered with dense semierect setae. *Elytra*. Female elytra with large, shiny spot medially on the basal third; standard pattern of pale, narrow maculae, humeral lunule with basal end quite straight with only a short medial projection and apical end on most specimens ending in a separate dot (on a few specimens complete), middle band partially complete, divided at apical end into a separate spot and connected with lateral expansion projecting both basally and apically along the margin, apical lunule separate and complete with basal projection narrow and curved slightly before ending on disc; elytral epipleura testaceous; apices microserulate; apical margins conjointly rounded; sutural spine short and obtuse. *Abdomen*. All sterna covered with dense, semierect setae which are denser laterally. *Legs*. Trochanters reddish testaceous, one subapical seta on each front and middle segment; hooked setae along entire posterior femoral margin; femora, tibiae and tarsomeres metallic green; tarsal claws small. *Male genitalia*. Aedeagus moderately slender, narrowest and gradually widening on basal half, widest on apical half, then tapering abruptly to a broad, blunt apex; small, rounded beak at tip slightly displaced to the right.

*Distribution*.—(Fig. 61). Found across the northern part of the Indian subcontinent in Pakistan (Sind), and India (Maharashtra, Rajasthan, Punjab, Haryana, Uttar Pradesh, Madhya Pradesh, Bihar, West Bengal). Also widely distributed in the Palearctic biogeographic region.

*Localities*.—INDIA: Haryana: Sultanpur, 24.VI.1983, pond edge (DLPC, CMNH); Sultanpur, 4.VII.1982, pond edge (DLPC); 10 km S Delhi, 3.VII.1982, pond edge (DLPC); 10 km S Chandigarh, 15.VII.1982, pond edge (DLPC); Rajasthan: Mount Abu, 1200 m, 27.IX.1984 (DLPC); Union Territory: Chandigarh, 29.VII.1982, pond edge (DLPC); New Delhi, Todapur, IARI, 31.III.1969, light trap (NMNH, CMNH); New Delhi, 1.VII.1967, light trap (NMNH, CMNH); Uttar Pradesh: Bijnor, 8.VII.1982, pond edge (DLPC).

*Ecology*.—Adults are found along the bare edges of muddy ponds and lakes. They also are attracted to lights.

### *Cicindela (Myriochile) undulata* Dejean

*Cicindela undulata* Dejean, 1825:94.

*Type status*. Syntype(s)? [unexamined; concept based on specimens! of both sexes labelled "India, Pondicherry, Karikal, X.1957," at CMNH]. *Type depository*. ?MNHN. *Type locality*. "Indes Oriental."

*Myriochile (sensu stricto) undulata* (Dejean): Rivalier, 1961:144.

*Myriochile (sensu stricto) undulata* (Dejean): Naviaux, 1984b:71, fig. 44-46.

*Diagnosis*.—Distinguished by the basal portion of humeral lunule reduced to a small dot or is entirely absent; female labrum tridentate, teeth acute; male labrum with one small acute medial tooth; female elytra slightly shiny medially on disc on basal third; proepisternal setae moderately abundant dorsally (on a few specimens setae sparse dorsally); numerous setae originating from multiple rows of foveae laterally on the pronotum.

*Description*.—*General habitus*. Body medium (10–12 mm); head and pronotum shiny green; elytra dull green, standard although narrowed and separated pattern of elytral maculae; body greenish bronze ventrally. *Head*. Labrum testaceous, short with four submarginal setae, three acute teeth (middle largest) on female, one small acute medial tooth on male; frons with fine longitudinal rugae extending onto vertex; rugae deeper adjacent to each eye; vertex surface medially moderately pebbled; frons, vertex and genae glabrous; mandibles with four long teeth distad basal molar, mandibles of female asymmetrical with second tooth on left mandible much larger than corresponding one on right man-

dible, mandibles of male symmetrical; last segment of labial and maxillary palpi metallic green. *Prothorax*. Pronotum subquadrate with sides parallel; pronotum with sparse appressed setae in one or two irregular rows laterally and scattered at anterior and posterior margins; pronotal surface covered with moderately raised pebbled surface; transverse sulci of pronotum shallowly impressed at middle; proepisterna glabrous along dorsal margin, remainder covered with semierect setae; prosternum with erect setae laterally. *Pterothorax*. Female mesepisternal coupling sulcus a narrow groove along posterior margin, forming a deep and elongate depression medially, surface anterior to groove smooth and glabrous on female, sparsely setose and slightly wrinkled on male; remaining pleura and sterna covered with dense appressed setae. *Elytra*. Elytral maculae with only the apical end of the humeral lunule, a transverse middle band expanded both basally and apically at the lateral margin with a divided mesal portion, and a complete apical lunule with the basal end extending mesad; small shiny area basally on female elytral disc; elytral epipleura testaceous; microsculptulations small; apical margins of male and female elytra separately rounded; sutural spine short. *Abdomen*. Sterna covered with dense, semierect setae except medially where fine erect hairs predominate. *Legs*. Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora with hooked setae along entire posterior margin; femora, tibiae and tarsomeres metallic green; tarsal claws small. *Male genitalia*. Aedeagus moderately slender, gradually widened on basal two-thirds, widest on apical third which is slightly bulky and tapers abruptly to a broad, rounded apex.

*Distribution*.—(Fig. 61). Occurs generally throughout the Indian subcontinent.

*Localities*.—INDIA: Punjab: 17 km N Rajpura, 27.VII.1982, pond edge (DLPC); Union Territory: Chandigarh, 29.VII.1982, pond edge (DLPC); Haryana: Sultanpur, 4.VII.1982, pond edge (DLPC); Bihar: 40 km S Palamau, 22.VI.1986, scrub forest (DLPC); 17 km N Hazaribagh, 21.VI.1986, sandy river bank (DLPC); Orissa: Simlipal National Park, 24,25.VI.1986, forest path (DLPC); Andhra Pradesh: 15 km N Salur, 30.VI.1986, scrub forest (DLPC); 57 km NW Hyderabad, 13.VII.1985, scrub forest (DLPC); 65 km N Hyderabad, 13.VIII.1985, mud pond edge (DLPC); 30 km E Warangal, 5.VII.1986, pond edge (DLPC); 109 km NE Warangal, 6.VII.1986, sandy river edge (DLPC); 60 km NW Tuni, 1.VII.1986, sandy river edge (DLPC); 15 km NW Waltair, 2.VII.1986, brackish mud flats (DLPC); Karnataka: 15 km SE Badami, 19.VI.1984, sandy river beach (DLPC); Sandur, 20.VI.1984, sandy river beach (DLPC); 10 km N Kanakapura, 1.VI.1984, sandy river beach (DLPC); 20 km W Shimoga, 11.VI.1985, scrub forest floor (DLPC); Bangalore, 19.V.1985, scrub forest floor (DLPC); 20 km W Dharwar, 18.VII.1986, forest path (DLPC); Jog Falls, 550 m, 10.VI.1987, forest path (DLPC); Jog Falls, 10.VI.1985, grassy meadow (DLPC); Tamil Nadu: 10 km W Dindigul, 19.V.1984, sandy river beach (DLPC); Kerala: 15 km E Palghat, 19.V.1985, sandy river beach (DLPC); 20 km E Palghat, 18.VII.1983, old field (DLPC); Union Territory: Pondicherry, Karikal, X.1957 (CMNH). SRI LANKA: Tissamaharama, 31.X.1983 (CMNH). NEPAL: Arun Valley, Sultibari, 500 m, 11–14.VI.1988 (JPC, CMNH).

*Ecology*.—Adults frequent the edges of small, temporary, muddy ponds, lakes and rivers. During the monsoon season, this habitat preference permits occupancy of old fields, scrub forest, and grassy meadows, away from permanent water. Adults are also attracted to lights (Naviaux, 1985).

### *Cicindela (Myriochile) dubia* Horn, new rank

*Cicindela dubia* Horn, 1892a:80.

*Type status*. Holotype, female! [by monotypy]. *Type labels*. “ex Coll., Dr. Richter” [typeset within thin black marginal line]; “Type!, Coll. W Horn” [typeset within thin black marginal line]; “Holotypus” [typeset red label]; “Coll. DEI, Eberswalde” [typeset]; “Holotype, *Cicindela dubia* W. Horn, by monotypy” [typed and handprinted red label]; “*Cicindela (Myriochile)*, *dubia* W. Horn, det. R.E. Acciavatti, '86” [typeset]. *Type depository*. Holotype at DEI. *Type locality*. Origin apparently unknown to Horn.

*Cicindela undulata dubia* Horn: Fowler, 1912:357.

*Diagnosis*.—Distinguished by the presence of a complete humeral lunule; completely setose proepisterna; pronotum with sparse, appressed lateral setae originating from one or two irregular marginal and submarginal rows.

*Description*.—*General habitus*. Body medium (10 mm); body shiny, greenish bronze dorsally; head and pronotum moderately sculptured; elytra with separate and complete lunules; punctures purple, moderately deep and dense over entire colored portions of disc; body greenish bronze ventrally. *Head*.



Labrum testaceous, short, with four submarginal setae, three acute teeth (middle largest) on female, one small acute medial tooth on male; frons with fine longitudinal rugae which extend onto vertex adjacent to each eye where they become deeper, rugae on vertex medially transverse, forming a moderately raised pebbled surface; frons, vertex and genae entirely glabrous; mandibles with four long teeth distad basal molar; last segment of labial and maxillary palpi metallic green. *Prothorax*. Pronotum subquadrate with sides parallel; pronotum with sparse appressed setae in one or two irregular rows laterally and at anterior and posterior margins; pronotal surface covered with a moderately raised reticular network; transverse sulci of pronotum shallowly impressed, posterior sulcus as shallow depression near lateral posterior angle and at middle; proepisterna completely covered with semierect setae; prosternum with erect setae laterally. *Pterothorax*. Female mesepisternal coupling sulcus a narrow slightly posteroventrally slanting groove, deepest medially; surface anterior to groove smooth and glabrous on female, slightly wrinkled and glabrous on male; sparse erect setae on mesepimera; remaining pleura and sterna covered by dense semierect setae. *Elytra*. Dense purple punctures cover surface; punctures moderately deep basally, shallow apically, wide laterally, narrower on disc; complete humeral lunule ending near lateral margin some distance from disc; middle band narrow extending nearly perpendicular to lateral margin for a short distance then parallel to it for an equal distance; discal end of middle band divided and slightly broader, separated on some specimens remaining attached by a thin line on other specimens; lateral expansion of middle band broadly attached and extending along margin anteriorly about half as far as posterior extension, anterior end acute, posterior end blunt; apical lunule complete from suture to outer apical angle where a narrow inward projection curves slightly anteriorly; female elytral disc on basal third with an inconspicuous only slightly shiny discal spot medially somewhat obscured by purple punctures inside it; elytral epipleura testaceous; female elytral apices separately rounded; male elytral apices cojointly rounded; microserrulations small; sutural spine short. *Abdomen*. Sterna covered with dense, semierect setae except medially where fine erect hairs predominate. *Legs*. Trochanters testaceous semitranslucent, one subapical seta on each front and middle segment; femora with hooked setae along entire posterior margin; femora, tibiae and tarsomeres metallic green; tarsal claws small. *Male genitalia*. Aedeagus moderately bulky, gradually widened on basal third, widest on middle third and tapering abruptly to a narrow, rounded apex which encompasses distal end of apical orifice; small subapical flange in left and right lateral aspects.

*Distribution*.—(Fig. 61). India (Assam, Nagaland) and Thailand. Also reported from Burma (Heynes-Wood and Dover, 1928).

*Localities*.—INDIA: Assam: Naga Hills, 615 to 1540 m, VI.1889 (DEI); Margherita, IV–V.1889 (MCZC). THAILAND: IX (CMNH).

*Ecology*.—Adults have been collected along the sandy banks of rivers in muddy areas with *Cicindela (Myriochile) undulata* and *Cicindela (Eugrapha) minuta*. They do not appear to be as common as these other two species.

*Remarks*.—*Cicindela (Myriochile) dubia* is closely related to *C. (Myriochile) undulata*, but represents a different species based on our studies; however, their relationship deserves additional study when more specimens become available.

Based solely on elytral maculae, Fowler (1912) considered assigning *Cicindela (Myriochile) dubia* to *C. (Myriochile) specularis* Chaudoir, 1865:24, (a replacement name for *C. speculifera* Chevrolat, 1845:96, preoccupied by *speculifera* Brullé, 1837:6), which occurs in the extreme eastern Palearctic and adjoining Oriental biogeographic regions. Such assignment is incorrect as both sexes of *Cicindela specularis* have a distinctive tridentate labrum and lack setae on the anterior half of lateral pronotal margin (on some specimens setae are very sparse or lacking along the entire lateral margin) whereas *C. dubia* males have a unidentate labrum and consistently possess sparse setae along the entire lateral pronotal margin.

### *Cicindela (Myriochile) atelesta* Chaudoir

*Cicindela imperfecta* Chaudoir, 1852:8 (preoccupied, LeConte, 1851:171).

*Type status*. Syntypes [unspecified number of specimens of each sex; unexamined; concept of this species is based on its original description in comparison with specimens! from India, Bihar, Pusa,



12.VII. 1915, at IARI]. *Type depository*. ?MNHNP. *Type locality*. "Environs de Simlah" (Simla, Himachal Pradesh, India).

*Cicindela atelesta* Chaudoir, 1854:115 (replacement name).

*Cicindela despecta* Fleutiaux, 1886a:88.

*Type status*. Syntypes [described from two males; unexamined; synonymy follows Horn (1926) who indicated one syntype represented another species, most likely *C. fastidiosa* Dejean]. *Type depository*. ?MNHNP. *Type locality*. "Indes Orientales Boreales."

*Myriochile (sensu stricto) atelesta* (Chaudoir): Rivalier, 1961:144.

*Cicindela melancholica nepalensis* Mandl, 1965:71, new synonymy.

*Type status*. Holotype, male! [by original designation; erroneously published as a female]. *Type labels*. "NEPAL, Kathmandu, 8.VIII.1962, 1400 m, leg. Ebert" [typeset and handprinted]; "Cic. melancholica, ssp. nepalensis m." [handscript]; "Cic. melancholica var. nordindien, Cat.5.172 DEZ 1905 p.62" [handscript on one-sided red orange label]; "Holo-typus, Cic. melancholica, ssp. nepalensis, m. 1964, det. Dr. K. Mandl" ['typus' and 'det. Dr. K. Mandl' typeset, remainder handscript on one-sided red orange label]. [Male genitalia of holotype and four legs pasted on pieces of paper.] Female allotype!, male paratype! each labelled "NEPAL, Kathmandu, 8.VIII.1962, 1400 m, leg. Ebert" [typeset and handprinted]. *Type depository*. Lectotype, allotype, and paratype at ZSBS. *Type locality*. "Kathmandu, Nepal."

*Nomenclatural note*.—Based on the holotype!, allotype! and one paratype! of *Cicindela melancholica nepalensis* Mandl, 1965, we conclude that this taxon is not conspecific with *C. melancholica* Fabricius, 1798, but differs from it by several major characters: 1) incomplete humeral elytral lunule, most specimens lack a macula at the humeral elytral angle (allotypic female has a small divided humeral lunule which holotype and paratype entirely lack) whereas *C. melancholica* Fabricius has a humeral macula; 2) proepisterna glabrous to sparsely setose on dorsal third whereas *C. melancholica* Fabricius has a densely setose proepisterna; 3) female mesepisternal coupling sulcus a short, medially situated, elongate groove rather than a groove only near the ventral edge as for *C. melancholica* Fabricius; 4) basal third of female elytral disc lacks a distinct, shiny area, whereas for *C. melancholica* Fabricius, a distinctive elytral shiny area is present on disc on basal third behind posterior portion of humeral lunule. In all these characters, the form *Cicindela melancholica nepalensis* Mandl, 1965, is nearly identical with our concept of *C. atelesta* Chaudoir, 1854, and herein considered a junior synonym.

The following published names have been associated with this species: *charactera* Sturm, 1826:117; *despecta* Chaudoir, 1865:24; however, because these names were neither described nor figured, they are unavailable.

*Diagnosis*.—Distinguished by the basal portion of humeral lunule entirely absent (reduced to a small dot on some specimens); labrum with three acute teeth; female elytral disc lacking a shiny area.

*Description*.—*General habitus*. Body medium (10–11 mm); dorsum dark brown with slight copper reflections; elytral maculae divided; body purple and blue-green ventrally. *Head*. Labrum short, testaceous; four submarginal setae and three minute teeth at anterior margin near middle on each sex; middle tooth largest on female; frons with fine longitudinal rugae which extend onto vertex adjacent to each eye where they become deeper; rugae on vertex forming a moderately raised pebbled surface; frons, vertex and genae entirely glabrous; last segment of labial and maxillary palpi metallic bronze green. *Prothorax*. Pronotum with sparse lateral setae originating from numerous rows of foveae; proepisterna glabrous to very sparsely setose on dorsal third, remainder covered with semierect and dorsoanteriorly oriented setae; erect lateral setae on prosternum. *Pterothorax*. Female mesepisternal coupling sulcus a short, medially situated, elongate groove; pleura and sterna covered with white semierect setae. *Elytra*. Maculae white; humeral lunule incomplete, on most specimens consisting only of a discal spot representing apical end of humeral lunule, on some specimens minute basal dot also present; a middle band whose extension along the lateral margin may be divided and whose extension onto the disc separated as a spot on most specimens (absent on some specimens), and a complete

apical lunule with a basal projection medially; female elytra without slightly shiny area on basal third of disc; elytral epipleura testaceous; female elytral apices separately rounded; male elytral apices cojointly rounded; microsculptulations small; sutural spine short. *Abdomen*. Sterna covered by dense, semierect setae except medially where fine erect hairs predominate. *Legs*. Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora with hooked setae along entire posterior margin; femora, tibiae and tarsomeres metallic green; tarsal claws small. *Male genitalia*. Aedeagus moderately slender, gradually widening on basal third, nearly of uniform width on apical two-thirds; apex tapering abruptly to a short rounded beak at tip; subapical flange minute and situated only in left lateral aspect mesad from beak.

*Distribution*.—(Fig. 61). India (Bihar, West Bengal, Uttar Pradesh, Gujarat, Maharashtra, Karnataka), Nepal, Sikkim and Bangladesh.

*Localities*.—NEPAL: Kathmandu, 8.VIII.1962, 1400 m (ZSBS). INDIA: Bihar: Pusa, 12.VII.1915 (IARI); Uttar Pradesh: Jhansi District, Babina, VIII.1987, 295 m (CMNH).

*Ecology*.—Adults occur at the edges of muddy ponds and water tanks, often syntopically with *C. melancholica* but are less abundant.

### *Cicindela (Myriochile) distinguenda* Dejean

*Cicindela distinguenda* Dejean, 1825:92.

*Type status*. Syntype(s)? [unexamined; concept based on specimens! of each sex labelled "India, Tamil Nadu, Tanjore District, Nedungadu, 3.IX.1938," at CMNH]. *Type depository*. ?MNHN. *Type locality*. "Indes Oriental."

*Myriochila dohrnii* Motschulsky, 1857:109.

*Type status*. Lectotype, female [here designated]. *Type labels*. "Tranq." [handscript]; "♀" [hand-printed small square]; "Myriochila, dohrnii, Westernm., Ind. or." [handscript lines on yellow label]; "LECTOTYPE, Myriochila, dohrnii Motschulsky, by R.E. Acciavatti, '86" [typed and handprinted red label]; "Cicindela (Myriochile), distinguenda Dejean, det. R.E. Acciavatti, 1986" [typeset]. [Lectotype is 12.5 mm; apex of abdomen destroyed by dermestid feeding; missing left hind and middle legs.] Paralectotype, male! [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. [Paralectotype lacking its prothorax and head.] *Type depository*. Lectotype and paralectotype at ZMMU. *Type locality*. "Indes Oriental" (undoubtedly southern India).

*Cicindela distinguenda lunatula* Horn, 1905b:35.

*Type status*. Holotype, male! [by monotypy]. *Type labels*. "Madras" [handscript]; "Type!, Dr. W Horn" (typeset within thin black marginal line); "Coll. DEI, Eberswalde" [typeset]; "HOLOTYPE, Cicindela, distinguenda, lunatula W. Horn, by monotypy" [typed and handprinted red label]; "Cicindela (Myriochile), distinguenda Dejean, det. R.E. Acciavatti, 1986" [typeset]. *Type depository*. Holotype at DEI. *Type locality*. "Madras" (Tamil Nadu, India).

*Cicindela distinguenda lunulata* (sic) Horn: Fowler, 1912:359.

*Myriochile (sensu stricto) distinguenda* (Dejean): Rivalier, 1961:144.

*Myriochile (sensu stricto) distinguenda* (Dejean): Naviaux, 1984b:71, fig. 50–52.

*Nomenclatural note*.—Walther Horn (1926) listed *Cicindela distinguenda lunatula* as an aberration of *Cicindela distinguenda* with which we concur; the two taxa are nearly identical, except for elytral markings, they occur together and the former taxon is not known to predominate in any population.

*Diagnosis*.—Distinguished by the metallic violet-black, green or reddish trochanters; humeral lunule divided on most specimens (complete on a few specimens), extending to middle of elytral disc; large, shiny area basally on female elytral disc.

*Description*.—*General habitus*. Body medium (10–12.5 mm); head and pronotum copper-green to green (on some specimens black-green); elytra dull, brown to black on disc and green laterally, varied pattern of maculae; body ventrally metallic copper-green and covered with appressed setae. *Head*. Labrum short testaceous; labrum tridentate, teeth closely spaced at middle along anterior margin;

male teeth small, female teeth large; four submarginal labral setae; frons, vertex and genae glabrous; finely rugose frons and vertex with a smooth broad margin immediately adjacent to eyes contrasting with numerous fine longitudinal rugae toward middle where rugae become transverse and irregular so that surface is finely pebbled; eyes bulging dorsally; last segment of labial and maxillary palpi metallic green. *Prothorax*. Pronotum finely rugose; proepisterna with surface rough, almost entirely covered with appressed dorsally oriented setae; prosternum with sparse appressed setae laterally. *Pterothorax*. Female mesepisternal coupling sulcus a narrow groove medially which slants postero-ventrally to form a moderately deep elongate depression ventrally; pleural surfaces roughened and, except for mesepisterna, completely covered with appressed setae; mesepisterna with sparse setae. *Elytra*. Elytral surface with small purple punctures deepest basally and laterally becoming nearly impunctate on disc and apically; maculae varied in size and shape; on most specimens six irregular spots representing both extremities of humeral lunule, central transverse portion of middle band with separate apical ends of its mesal extension and marginal band, and a complete apical lunule with a mesal extension of basal portion; on some specimens humeral lunule complete and marginal band broadly joining transverse middle band (as for aberration *lunatula*); female elytra with a slightly shiny area medially on disc on basal third; elytral epipleura testaceous, nonmetallic; elytral apices conjointly rounded; microserrulations small; sutural spine small. *Abdomen*. Sterna covered with appressed setae except at middle which is covered with fine erect hairs. *Legs*. Trochanters metallic, violet to greenish black, on some specimens tinged dark reddish, one subapical seta on each front and middle segment; femora with hooked setae along posterior margin; femora, tibiae and tarsomeres metallic green; tarsal claws quite small. *Male genitalia*. Aedeagus moderately slender, gradually widening on basal third, widest and of nearly uniform width on apical two-thirds, tapering abruptly to a short, acutely rounded beak at apex not displaced to the right; subapical flange very small and situated only on left lateral aspect just below beak.

*Distribution*.—(Fig. 61). Southern India (Andhra Pradesh, Karnataka, Tamil Nadu and Kerala) and Sri Lanka.

*Localities*.—INDIA: Tamil Nadu: Madurai, 14.XI.1984 (DLPC); Tanjore (Thanjavur) District, Nedungadu, 3.IX.1938 (CMNH); Union Territory: 7 km S Pondicherry, 22.I.1985 (DLPC); Karnataka: Badami, 19.VI.1984, sandy river bank (DLPC); Andhra Pradesh: 15 km NW Waltair, 2.VII.1986, brackish mud flat (DLPC). SRI LANKA: Puttalam District: Puttalam, 1.V.1981 (RNC, CMNH); Anuradhapura District: Padaviya, 55 m, 2–8.IX.1970 (NMNH); Jaffna District: Kilinochchi, 5 m, 7.IX.1970 (NMNH); Mannar District: 6 km NW Mannar, 30 m, 3.XI.1976, black light (NMNH).

*Ecology*.—Adults occur along river edges and brackish mud puddles primarily near the ocean. Naviaux (1984b) reported on the rapid and lofty adult flight and their attraction to lights; he also noted this species occurred with *C. angulata*.

### Subgenus *Cicindela* (*Salpingophora*) Rivalier

*Salpingophora* Rivalier, 1950:242.

Type species.—*Cicindela maindroni* Horn, 1897.

*Salpingophora* Rivalier: Rivalier, 1958:244.

*Salpingophora* Rivalier: Rivalier, 1961:144.

*Diagnosis*.—*Cicindela* (*Salpingophora*) species adults are characterized by the following structures: 1) large cupped flagellum in the internal sac of the male genitalia; 2) head broadly concave between two laterally bulging and very flat eyes; 3) labrum short testaceous with four submarginal setae and small teeth; 4) head and pronotum almost totally glabrous; 5) ventral surface of body with abundant dense decumbent white setae obscuring most pleura and sterna; 6) elytral pattern typically as a continuous wavy band along the entire lateral margin of elytra.

*Included species*.—*Cicindela* (*Salpingophora*) species occur where the Palearctic and Oriental biogeographic regions interface along the Persian Gulf and Arabian

Sea; the following two species enter the Indian subcontinent: *C. (S.) maindroni* Horn, 1897; *C. (S.) bellana* Horn, 1905.

Key to adults of *Cicindela (Salpingophora)* species

1. Prosternum setose anterior to front coxae ..... *maindroni* Horn
- Prosternum glabrous anterior to front coxae ..... *bellana* Horn

*Cicindela (Salpingophora) maindroni* Horn

*Cicindela maindroni* Horn, 1897c:98.

*Type status.* Lectotype, female [here designated]. *Type labels.* "Maindron, Kurrachee" [handscript]; "Type!, coll. W. Horn" [typeset within a thin black marginal line]; "Syntypus" [typeset red label]; "Coll. DEI, Eberswalde" [typeset]; "LECTOTYPE, Cicindela, maindroni W. Horn, by R.E. Acciavatti, '85" [typed and handprinted red label]. [Lectotype is 16 mm; right antenna repaired with glue.] Paralectotypes, two males! each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository.* Lectotype and two paralectotypes at DEI. *Type locality.* "Kurrachee (Sind)" (Karachi, Sind, Pakistan).

*Salpingophora maindroni* (Horn): Rivalier, 1961:144.

*Diagnosis.* — Distinguished by the large body size; setose prosternum; only dense, erect setae on femora.

*Description.* — *General habitus.* Body medium to large (14–16 mm); head and pronotum shiny, dark bronze (on some specimens bronze-green), slight green reflections laterally; elytra bronze to bronze-green; maculae as a broad, continuous lateral band extending from humeral angle apically to suture with the medial edge straight on basal half becoming wavy on apical third; body ventrally shiny bronze with abundant decumbent white setae covering much of the surface. *Head.* Antennal scape with one subapical seta; mandibles bent slightly posteriorly; labrum short, creamy white with four submarginal setae and three small, acute teeth at middle, coequal in length; genae, clypeus, frons and vertex entirely glabrous; clypeus constricted at middle; eyes large, bulging laterally; vertex flattened with numerous shallow longitudinal rugae becoming wavy behind eyes. *Prothorax.* Pronotum nearly quadrate, posterior angles forming nearly at right angles, distinctively bulging at corner; lateral suture between pronotum and proepisterna raised with both surfaces meeting at an acute angle; pronotal surface completely glabrous with irregular, only slightly impressed, rugae on disc; moderately raised anterior and posterior margins; transverse sulci shallowly impressed with anterior sulcus sloping posteriorly at middle, posterior sulcus straight; proepisterna almost completely covered with decumbent setae which project ventrally; prosternum with surface moderately coarse and with sparse, erect setae. *Pterothorax.* Female mesepisternal coupling sulcus a large, moderately deep pit at posterodorsal margin; mesepisterna nearly covered by dense setae and remaining pleura completely covered by setae. *Elytra.* Surface with small, blue-green punctures, a row of small purple foveae nearly at middle of pigmented area, and distinctly granulate only on basal quarter; maculae as a wide lateral band from humeral angle extending apically to suture with medial edge straight along two-thirds its length, band wavy with a medial projection and a lateral constriction followed by a medial bulge all on apical third; elytral apex conjointly rounded on each sex with small microsculptulations and a large, prominent sutural spine. *Abdomen.* All sterna laterally with dense, decumbent setae, medially with fine hairs on anterior portion of each sternum, glabrous on posterior portion. *Legs.* Trochanters reddish testaceous, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres metallic copper-green; proximal two-thirds of front and middle femora with dense, erect setae projecting ventrally along posterior and anterior margins. *Male genitalia.* Aedeagus with a long, bulging flange on the left in left lateral aspect extending from narrow proximal neck almost to large apical orifice; apex tapering abruptly to a slender, rounded tip.

*Distribution.* — (Fig. 62). Pakistan (Baluchistan, Sind).

*Localities.* — PAKISTAN: Sind: Karachi, 23.IX.1928 (DEI); 15 mi W Karachi, 10.VII.1975, sandspit (FCC, CMNH); Hyderabad, VIII.1965 (CMNH).

*Ecology.* — Fowler (1912) reported this species from clayey sands, and Cassola (1976) mentioned its occurrence on hard, compact soils near water.

*Cicindela (Salpingophora) bellana* Horn

*Cicindela bellana* Horn, 1905a:63.

*Type status.* Lectotype, male [here designated]. *Type labels.* "T.R. Bell, Karachi" [typeset]; "Co-, type" [typeset on circular label with green border]; "Cicindela bellana Cotype Horn" [handscript]; "S. India, Kanara, T.R. Bell, B.M. 1934-394" [typeset]; "LECTOTYPE, Cicindela, bellana W. Horn, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 11.5 mm; missing left middle and hind legs.] Paralectotypes, one each sex! at DEI, four females! and one male! at IRSNB, each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. [A possible syntypic male! at IRSNB is not labelled "T.R. Bell, Karachi" and so must be disregarded as a syntype.] [Three syntypes at BMNH (G. G. Kibby, personal communication, 1983); unexamined.] *Type depository.* Lectotype at BMNH; two paralectotypes at DEI, and four at IRSNB. *Type locality.* "Karachi" (Pakistan).

*Cicindela bellana nuda* Horn, 1905b:38.

*Type status.* Lectotype, female [here designated]. *Type labels.* "T.R. Bell, Karachi" [typeset]; "Co-, type" [typeset on circular label]; "C. bellana, v. nuda Horn, nov. var., cotype" [typeset]; "S. India, Kanara, T.R. Bell, B.M. 1934-394" [typeset]; "LECTOTYPE, Cicindela bellana, nuda W. Horn, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 11 mm.] Paralectotype, female! at DEI [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. [Seven more syntypes exist at BMNH (G. G. Kibby, personal communication, 1983); unexamined.] *Type depository.* Lectotype at BMNH; paralectotype at DEI. *Type locality.* "Karachi" (Pakistan).

*Salpingophora bellana* (W. Horn): Rivalier, 1961:144.

*Salpingophora bellana* (W. Horn): Naviaux, 1983:85, fig. 26, 51.

*Diagnosis.*—Distinguished by its medium body size; glabrous prosternum; femora with both dense, erect white setae and finer, hooked setae.

*Description.*—*General habitus.* Body medium (11.5–14 mm); head and pronotum blue-green to copper; elytral pigmentation varied, some specimens bronze, others copper; elytral maculae varied, on some specimens consisting of a broad, continuous lateral band from humeral angle to suture with a sinuate medial margin; on some specimens maculae almost entirely absent; body ventrally golden green with abundant decumbent, white setae. *Head.* Antennal scape with one subapical seta; labrum ivory, short with four submarginal setae and three small medial teeth coequal in length; genae, clypeus and vertex glabrous; eyes large, bulging laterally, flattened dorsally; vertex broadly convex adjacent to eyes and narrowly concave at middle with surface smooth next to eyes becoming moderately coarse medially with rugae longitudinal at middle, wavy posteriorly; distal two segments of maxillary palpi and last segment of labial palpi dark, metallic. *Prothorax.* Pronotum glabrous, subquadrate with surface covered by moderately coarse and wavy rugae, posterior angles rounded and slightly narrower than anterior angles, disc rounded, transverse sulci shallowly impressed with anterior reflexed margin wider than posterior margin; propisterna covered with dense, white decumbent setae projecting ventrally; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a broad, medial groove, deepest dorsally and slanting posteroventrally, surface with moderately impressed rugae divided into small segments which make surface pebbly; dense decumbent setae along posterior margin of mesepisterna and covering other pleura. *Elytra.* Surface coarsely granulate-punctate basally to moderately so apically, punctures somewhat oval, shallow and blue-green, a row of small, purple foveae running longitudinally through pigmented area; two short rows of two to five copper foveae in depression mesad of humeral angle contrasting with maculae; maculae as a marginal band extending along entire lateral edge (some specimens nearly immaculate) narrowly projecting onto basal area but not reaching scutellum, broadly extending medially as a rounded bulge at middle more than half way toward suture, constricted to a narrow line (nearly divided on some specimens) where margin bends apically, and broadly expanded to nearly cover apical quarter; elytral apex evenly rounded on both sexes, micro-serrulate with minute teeth and a small sutural spine. *Abdomen.* Sterna laterally with moderately dense, decumbent white setae on first five sterna on female and on all sterna on male, disc covered with long, abundant hairs on both sexes. *Legs.* Trochanters dark reddish slightly metallic, one subapical seta on each front and middle segment; coxae golden; femora and tibiae metallic copper-green; tarsomeres purple-green; front and middle femora with dense, erect, white setae on front and rear margins and finer hooked setae between these, all projecting ventrally along proximal three-quarters of their length, only scattered erect setae on posterior femora. *Male genitalia.* Aedeagus short with body wall in left lateral aspect evenly curved on left, relatively straight on right, apex tapering abruptly to a blunt tip.

*Geographic variation.*—Specimens! occurring at the type locality with elytral maculae reduced to only a faint, diffused patch at humeral angle represent the taxon *Cicindela bellana nuda*, described as an aberration by Walther Horn and herein similarly treated because they coexist with fully maculated specimens. Specimens! from the western Persian Gulf possess elytral maculae expanded apically so as to reduce the size of the posterior pigmented area adjoining the lateral margin; additionally, certain specimens! from there have a completely copper colored dorsum.

*Distribution.*—(Fig. 62). Pakistan (Sind) westward along the Persian Gulf of Iran, Iraq and Kuwait.

*Localities.*—PAKISTAN: Sind: Karachi (DEI); IRAN: Buschehr (Bushehr), 29–30.IV.1926, 1–5.V.1926 (DEI); Bushire (Bushehr) 18.VI.1930 (DEI, CMNH). KUWAIT (KUWAIT) (DEI).

*Ecology.*—Adults occur on the hard, compact bare ground near moist habitats along the seacoast. Naviaux (1983) considered it less abundant than other species occupying the same habitat.

### Subgenus *Cicindela* (*Hypaetha*) LeConte

*Hypaetha* LeConte, 1860:28.

Type species.—*Cicindela quadrilineata* Fabricius, 1781.

*Hypaetha* LeConte: Rivalier, 1950:241.

*Hypaetha* LeConte: Rivalier, 1961:144.

*Nomenclatural note.*—Motschulsky (1859:25) used the combinations *Cylindrostoma biramosa* and *Cylindrostoma quadrilineata* for these two Fabrician species without a description, illustration or indication that the use of this generic name was new; therefore, this generic name is unavailable according to the Code (Article 12) (ICZN, 1985). Horn (1926) also treated *Cylindrostoma* as unpublished.

*Diagnosis.*—*Cicindela* (*Hypaetha*) species adults can be distinguished from those of other subgenera by: 1) male genitalic flagellum reduced to a small, uncoiled sclerite; 2) proepisterna bulging dorsally so that pronotopleural suture appears on dorsal surface; 3) head broadly concave between two laterally bulging and very flat eyes; 4) short, testaceous labrum with four submarginal setae and moderately developed teeth; 5) head and pronotum almost totally glabrous, the latter with small, dense setae at anterior and posterior margins; ventral surface on most specimens with abundantly dense decumbent white setae obscuring most of body; 6) elytral pattern as continuous lateral and sutural bands varied from separate for two species to merged at one or more places for the other species.

*Included species.*—These *Cicindela* (*Hypaetha*) species occur on the Indian subcontinent: *C. (H.) quadrilineata* Fabricius, 1781; *C. (H.) biramosa* Fabricius, 1781; *C. (H.) copulata* Schmidt-Goebel, 1846; *C. (H.) ornatipennis* Schilder, 1953.

### Key to adults of *Cicindela* (*Hypaetha*) species

1. Abdomen setose laterally ..... *quadrilineata* Fabricius
  - Abdomen glabrous laterally ..... 2
- 2.(1.) Three short labral teeth, coequal in size ..... *biramosa* Fabricius
  - One to three minute, rounded labral teeth, center one largest ..... 3
- 3.(2.) Posterior femora long, extending more than one-third of their length beyond end of body ..... *ornatipennis* Schilder
  - Posterior femora short, not extending more than one-third of their length beyond end of body ..... *copulata* Schmidt-Goebel



***Cicindela (Hypaetha) quadrilineata* Fabricius**

*Cicindela quadrilineata* Fabricius, 1781:285.

*Type status.* Lectotype, male [here designated]. *Type labels.* "4 lineata" [handscript]; "Zool. Museum, DK Copenhagen" [typeset]; "LECTOTYPE, *Cicindela, quadrilineata* Fabr., by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 19 mm; both antennae broken; missing right middle and hind legs; pinned through the left elytron, hole in right elytron.] Paralectotype, male! [one of two mentioned by Zimsen (1964)] [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. [The other male syntype could not be found at ZMUC (O. Martin, personal communication, 1983) and must be considered lost.] *Type depository.* Lectotype and paralectotype at ZMUC. *Type locality.* "India."

*Cicindela millingeni* Bates, 1878b:329, new synonymy.

*Type status.* Holotype, female [by monotypy; unexamined; concept based on specimens! from India, Pamben, Gulf of Mannar, 24.II.13 at DEI]. *Type depository.* ?MNHNP. *Type locality.* "Bushire, Persian Gulf" (Bushehr, Iran).

*Cicindela renei* Horn, 1897a:273, new synonymy.

*Type status.* Lectotype, male [here designated]. *Type labels.* "R. Oberthur" [typeset]; "Hindustan Mérid!, Trichinopoly, R.P. Castets" [typeset]; "Type!, coll. W. Horn" [typeset within thin black marginal line]; "Syntypus" [typeset red-orange label]; "Coll. DEI, Eberswalde" [typeset]; "LECTOTYPE, *Cicindela, renei* W. Horn, by R. E. Acciavatti, '86" [typed and handprinted red label]. [Lectotype is 14 mm.] Paralectotypes, one each sex! from Trichinopoly, and one each sex! from Ceylon, each [here designated] labelled "PARALECTOTYPE" [typed and handprinted red label]. *Type depository.* Lectotype and four paralectotypes at DEI. *Type locality.* "Trichinopolis" (Tiruchchirappalli, Tamil Nadu, India).

*Hypaetha quadrilineata* (Fabricius): Rivalier, 1961:144.

*Hypaetha quadrilineata* (Fabricius): Naviaux, 1983:83, fig. 20, 47, 70.

**Diagnosis.**—Distinguished by the laterally setose abdomen.

*Description.*—*General habitus.* Body medium to large (14–19 mm); head and pronotum copper, the latter with metallic green reflections in transverse sulci; elytra dark greenish bronze with two longitudinal yellow-white bands of varied width; body ventrally nearly covered with dense, decumbent setae except at middle. *Head.* Labrum short, white; three small acute teeth at middle anteroventrally directed, four to six submarginal setae; mandible with basal tooth broad and often bifurcate; frons with numerous fine, longitudinal ridges which extend onto vertex; eyes large and bulging laterally; clypeus, frons, vertex and genae glabrous. *Prothorax.* Pronotum with moderately coarse irregular rugae, entirely glabrous; proepisterna completely covered with dense, erect setae which are ventrally oriented and appear on the dorsal surface; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a narrow groove along posterior margin, deepest at middle; pleura (except mesepisterna) and sterna (except metasternum) nearly covered by erect ventrally directed setae. *Elytra.* Elytral surface with uniformly dense and deep minutely granulate punctures on dark areas; maculae as two longitudinal yellow-white bands of varied width; on some specimens the lateral band thin and continuous from humeral angle to apical spine and the sutural one is broad with both bands merging at the base but separated just before the apex; on other specimens both bands are merged at apex; on a few specimens bands merge medially for a short distance and apically; elytral apices with large microsculptations, margin separately rounded on each sex, more curved on female than male; sutural spine long. *Abdomen.* Sterna pale copper, completely covered with dense, erect setae except at center. *Legs.* Trochanters nonmetallic dark brown, one subapical seta on each front and middle segment; femora metallic green covered with long white setae; tibiae and tarsomeres metallic green; tarsal claws long. *Male genitalia.* Aedeagus large and long, gradually widening on basal two-thirds and slightly bulky on apical one-third where genitalic capsule is widest, apex blunt and rounded with an extremely long, semisclerotized protuberance extending to the left from a highly sclerotized beak on the right.

*Geographic variation.*—Specimens representing the taxon *Cicindela renei* differ from *C. quadrilineata* by the two bands broadened, merging at apex and touching medially, whereas specimens of the taxon *C. millingeni* are similar to *C. quadrilineata* but the bands are separate along their length and consistently merged at their apex. These two taxa are to be considered only aberrations because they



occur with *Cicindela quadrilineata* at various locations throughout its range (Fowler, 1912; Cassola, 1976).

*Distribution.*—(Fig. 62). Found along the entire coast of the Indian subcontinent and Sri Lanka, this species also ranges westward to the Persian Gulf and eastward along the coast of Burma to Tenasserim and extreme northern parts of the Malay Peninsula (Naviaux, 1987).

*Localities.*—INDIA: Tamil Nadu: Madurai District, Shembaganur (DEI); Kilakarai, II.13 (DEI); Tiruchchirappalli (DEI); Pamben, Gulf of Mannar, 24.II.13 (DEI); Point Calimere, X.1971, sea level (CMNH); Union Territory: 7 km S Pondicherry, 22.I.1985, ocean beach (DLPC); Andhra Pradesh: 15 km NW Waltair, 2.VII.1986, ocean beach (DLPC). SRI LANKA (DEI). PAKISTAN: Sind: 25 km W Karachi, 10.VII.1975, sandspit (FCC, CMNH). IRAN: Bandar-Abbas, 27.IV.1971 (RNC, CMNH); Bandar-Shahpur, VII (CMNH).

*Ecology.*—Adults occur in sandy areas along coastal beaches and inland along rivers. Reported by Fowler (1912) from sandy areas of Manorah, near Karachi, Pakistan, associated with *Cicindela (Hypaetha) ornatipennis*. Records from interior localities away from the coast likely represent a temporary dispersal to more favorable habitats inland. Naviaux (1983) observed a rapid dispersal for large numbers of this species when local conditions became unfavorable along the coastal beaches of Iran.

### *Cicindela (Hypaetha) biramosa* Fabricius

*Cicindela biramosa* Fabricius, 1781:286.

*Type status.* Lectotype, male [here designated]. *Type labels.* "2 ramosa/Calcoa" [handwritten by Fabricius on both sides of label, second word uncertain]; "Zool. Museum, DK Copenhagen" [typeset]; "LECTOTYPE, *Cicindela, biramosa* Fabricius, by R.E. Acciavatti, '82" [typed and handprinted red label]. [Lectotype 12 mm; pinned through left elytron; both antennae and front leg broken; middle left leg missing.] [Two possible syntypes in the Hunterian Collection at Glasgow University, Scotland (Staig, 1931; Zimsen, 1964); unexamined; we followed the Code (Recommendation 74D) (ICZN, 1985) in designating a lectotype with respect to these syntypes.] *Type depository.* Lectotype at ZMUC. *Type locality.* "in Germania" (Germany; erroneous).

*Cicindela tridentata* Thunberg, 1781:26, fig. 40.

*Type status.* Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository.* Unrecorded. *Type locality.* "Ceylona and Coromandelia."

*Cicindela biramosa contracta* Fleutiaux, 1893b:488.

*Type status.* Syntype(s)? [unexamined; treatment follows Horn (1926)]. *Type depository.* ?MNHNP. *Type locality.* "Tenasserin" (Burma).

*Cicindela biramosa dilata* Fleutiaux, 1893b:488.

*Type status.* Syntype(s)? [unexamined; concept based on specimens! from Tricomalee, Sri Lanka, at CASS]. *Type depository.* ?MNHNP. *Type locality.* "Ceylon" (Sri Lanka).

*Hypaetha biramosa* (Fabricius): Rivalier, 1961:44.

*Hypaetha biramosa* (Fabricius): Naviaux, 1984b:76, fig. 63–65.

*Hypaetha biramosa* (Fabricius): Naviaux, 1987:79, fig. 19–21.

*Diagnosis.*—Distinguished by the abdomen glabrous laterally; labrum tridentate, teeth medially situated and coequal in size.

*Description.*—*General habitus.* Body medium (10–14 mm); dorsum shiny dark bronze to bronze-green with copper reflections or dark blue-green almost black; elytral maculae a wavy white lateral band from humeral angle to apical spine, subspecifically varied in width; body shiny purple ventrally. *Head.* Labrum short, ivory colored with three short teeth close together at middle; four to six submarginal labral setae; vertex of head flat between laterally bulging eyes. *Prothorax.* Pronotum completely glabrous; propisterna with numerous, long erect setae except near dorsal margin. *Pterothorax.*

Mesepisterna ventrally with erect setae on both sexes; female mesepisternal coupling sulcus a broad shallow groove. *Elytra*. Elytral surface shallowly granulate-punctate, punctures deepest basally; elytra with an irregular row of small, blue, subsutural foveae; elytral maculae a wavy white lateral band subspecifically varied in width (refer to geographic variation) from humeral angle to apical spine with a bulge toward the disc on the middle (on a few specimens as a separate spot) and on apical third; elytral apex microserulate. *Abdomen*. Sterna completely glabrous. *Legs*. Trochanters metallic purple, one subapical seta on each front and middle segment; femora metallic copper and green; tibiae and tarsomeres purple; tarsal claws long. *Male genitalia*. Aedeagus moderately slender, gradually widening on apical third and nearly the same width on middle third before tapering abruptly on apical third to a broad, blunt apex; wide beak on the right; long flange midway along the left on both left and right lateral aspects creating a narrow concavity on the left side.

*Geographic variation*.—Three subspecies of *Cicindela biramosa* have been recognized based on elytral maculae: nominal *C. biramosa* with a lateral band narrowed and bulging mesad at the middle (on some specimens as a separate spot) and on the apical third; *C. biramosa dilata* with the lateral band expanded so as to obscure the medial bulge; *C. biramosa contracta* with a narrow (on a few specimens divided) lateral band and small, separate medial spot. We consider *C. biramosa dilata* only an aberration because our observations and those of Naviaux (1984b) indicate it does not predominate in any population. Naviaux (1987) concluded that *C. biramosa contracta* should be retained as a subspecies because it characterizes populations existing along the northwestern coast of the Malay Peninsula. We have not studied these populations but follow his judgement about their subspecific status.

*Distribution*.—(Fig. 63). Nominal *Cicindela biramosa* occurs along southern coast of India (Karnataka to West Bengal), Bangladesh and Sri Lanka. Aberration *Cicindela biramosa dilata* more commonly found on the east side of Sri Lanka. *Cicindela biramosa contracta* occurs along the southern Burmese coast and northwest coast of Malay Peninsula in Thailand and Malaysia.

*Localities*.—SRI LANKA: Mannar, Pesalai, 9.IV.1981 (DLPC); Trincomalee, VII.1972 (CMNH). INDIA: Union Territory: Pondicherry, Karikal, II.1981, sea level (CMNH); Karikal, X.1981, sea level (CMNH); Tamil Nadu: Cuddalore, 24.I.1985, ocean beach (DLPC); Rameswaram Island, 12.IX.1986, ocean beach (DLPC); Thanjavur District, Point Calimere, X.1980 (CMNH); Tirunelveli District, 2 to 3 km S Manapad, X.1986 (CMNH); Kerala: Calicut, 30.X.1984, ocean beach (DLPC); 9 km SE Trivandrum, 25.V.1986, ocean beach (DLPC); Cannanore District, Tellicherry, X.1977 (CMNH); Mahe, X.1973 (CMNH); Andhra Pradesh: 15 km NW Waltair, 2.VII.1986, ocean beach (DLPC); Karnataka: Karwar, sea level, 12.VI.1987, ocean beach (DLPC).

*Ecology*.—Adults are confined to undisturbed outer sandy ocean beaches. Naviaux (1984b) reported its habitat preference to be the intertidal zone where adults sometimes hunt even while standing in water.

### *Cicindela (Hypaetha) copulata* Schmidt-Goebel

*Cicindela copulata* Schmidt-Goebel, 1846:9.

*Type status*. Holotype, female [by monotypy; examined by J. Probst, (personal communication, 1988) at our request, compared with a specimen! sent to him and returned to CMNH for reference]. *Type labels*. "Typus! teste, Dr. Obenberger" [printed red label]; "Calcutta" [handscript]; "Mus. Pragense, Tenasserim, Coll. Helfer" [printed]; "Cicindela copulata Schm., G. Unicum. Typus!, test me, exemplar decapitum, Det. Dr. Obenberger 1920" [printed and handwritten, second word underlined]. [Holotype lacks its head.] *Type depository*. Holotype at NMP. *Type locality*. "Cossipore near Calcutta" (erroneous).

*Cicindela copulata* Schmidt-Goebel: Fowler, 1912:204, fig. 193.

*Hypaetha copulata* (Schmidt-Goebel): Rivalier, 1961:44.

*Hypaetha copulata* (Schmidt-Goebel): Naviaux, 1983:84, fig. 22, 48, 71.

**Diagnosis.**—Distinguished by the small size; laterally glabrous abdomen; one to three inconspicuous rounded labral teeth.

**Description.**—*General habitus.* Body small (8 mm); dorsum shiny bronze with bright metallic green reflections laterally and on rugae of the head and in transverse sulci of the pronotum; standard pattern of elytral maculae, all lunules broadened and connected laterally; body bronze and green ventrally. *Head.* Male mandible asymmetrical with four teeth on the left and three on the right mandible distad basal molar; apical tooth long nearly equal to half of entire mandible length; labrum short, white with a minute medial tooth and four submarginal setae on each sex; vertex finely sculptured; frons, clypeus, vertex and genae glabrous; eyes flattened and bulging laterally. *Prothorax.* Pronotum glabrous with moderate surface sculpturing and impressed transverse sulci; proepisterna with abundant, long white setae which appear on the dorsal surface; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a broad shallow groove and a small, shallow depression basally. *Elytra.* Standard pattern of elytral maculae entirely fused along lateral margin from basal dot to apex, sutural band merged with basal dot and with middle band at its transverse portion (on some specimens narrowly separated at this point); elytral apices microserrulate; apical margins separately rounded on each sex but more curved on female than male; female sutural spine long, retracted. *Abdomen.* Sterna completely glabrous. *Legs.* Trochanters pale, nonmetallic, one subapical seta on each front and middle segment; femora metallic green; tibiae and tarsomeres pale testaceous. *Male genitalia.* Aedeagus very slender, gradually widened on basal two-thirds to a nearly uniform width on apical third, then evenly tapering to a large, rounded apex; lightly sclerotized beak on the right side in left lateral aspect.

**Distribution.**—(Fig. 63). Occurs along the southern coast of Pakistan. Ranges westward along northern edge of the Persian Gulf in Iran.

**Localities.**—PAKISTAN: Sind: Karachi, 9.VIII.1984, sandspit (CMNH); Karachi, 15.VIII.1956, beach (CMNH). IRAN: Kuhestak, 25.IV.1971 (RNC, CMNH); Bandar-Abbas, 27.IV.1971 (RNC, CMNH).

**Ecology.** Adults are found in sandy seashore beach habitats. Cassola (1976) reported that adults were collected on dry portions of a small stream not far from where it joined the sea. Naviaux (1983) mentioned the abundance of adults which flew minimally compared to running along sandy banks.

### *Cicindela (Hypaetha) ornatipennis* Schilder

*Cicindela ornata* Fleutiaux, 1898:146 (preoccupied, Klug, 1834:17).

**Type status.** Syntype(s)? [unexamined; concept based on a comparison of its original description with specimens! from the type locality at BMNH]. **Type depository.** ?MNHN. **Type locality.** "Karachi" (Pakistan).

*Cicindela ornatipennis* Schilder, 1953:313 (replacement name).

*Hypaetha ornata* (Fleutiaux): Rivalier, 1961:44.

*Hypaetha ornata* (Fleutiaux): Naviaux, 1983:84, fig. 23, 49, 72.

**Nomenclatural note.**—The replacement name for this species proposed by Schilder (1953), although overlooked by recent authors, is valid and should still stand. *Cicindela ornata* Klug, 1834, was subsequently placed in genus *Prothyma* Hope, 1838.

**Diagnosis.**—Distinguished by the very long posterior femora; medium body size.

**Description.**—*General habitus.* Body medium (11–12 mm); head and pronotum bright copper-red; elytral shape ovate, copper along the suture and on each elytron on two linear areas formed by a widened and confluent pattern of maculae; body copper ventrally. *Head.* Labrum short, white with one small medial tooth, four submarginal setae; vertex finely sculptured; frons, clypeus, vertex and genae glabrous. *Prothorax.* Pronotum glabrous, finely sculptured; proepisterna covered with dense, decumbent setae which appear on the dorsal surface; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a broad shallow groove. *Elytra.* Shape ovate; pattern of maculae consisting of wide, lateral and subsutural bands broadly confluent at the middle of each elytron; apex microser-

ulate with margins truncated; sutural spine small. *Abdomen*. Sterna completely glabrous. *Legs*. Trochanters pale nonmetallic, one subapical seta on each front and middle segment; femora metallic green, posterior pair very long, extending one-third of their length beyond body; tibiae and tarsomeres pale testaceous. *Male genitalia*. Aedeagus small, slender, gradually widened on basal half, widest at middle and evenly tapering on apical half to a large, rounded beak on the right; left side in left lateral aspect arched whereas right side nearly straight (Naviaux, 1983).

*Distribution*. — (Fig. 63). The coast of Pakistan (Sind) and Iran. A doubtful record exists for Karnataka, India (Heynes-Wood and Dover, 1928).

*Localities*. — PAKISTAN: Sind: Karachi (BMNH). IRAN: Kuhestak, 25.IV.1971 and Sirrik, 1.VI.1973 (Naviaux, 1983).

*Ecology*. — Adults are found near the seashore in sandy habitats.

### Subgenus *Cicindela* (*Callytron*) Gistel

*Callytron* Gistel, 1848:111.

Type species. — *Cicindela limosa* Saunders, 1836.

*Achemenia* Rivalier, 1950:243.

Type species. — *Cicindela monalisa* Horn, 1927.

*Callytron* Gistel: Rivalier, 1961:147.

*Diagnosis*. — *Cicindela* (*Callytron*) species adults are distinguished from those of other subgenera by: 1) a deformed almost unrecognizable flagellum within the male genitalic inner sac, flagellum spread widely at base of inner sac with short projections and a large central plate irregularly shaped and foliated with several grooved extensions; 2) pronotopleural suture appearing on dorsal surface; 3) head broadly concave between two laterally bulging and very flat eyes; short, testaceous labrum with four to ten submarginal setae and moderately developed teeth; 4) pronotum with acute posterior angles; 5) ventral surface of body with very sparse setae; 6) elytral pattern forming a narrow, continuous band along lateral margin or totally absent; 7) long and slender legs with femora noticeably swollen at their base.

*Included species*. — *Cicindela* (*Callytron*) represents a small grouping of species, mostly confined to the Oriental biogeographic region, the following of which inhabit the coastal margins of the Indian subcontinent: *C. (C.) limosa* Saunders, 1836; *C. (C.) gyllenhalii* Dejean, 1825; *C. (C.) malabarica* Fleutiaux and Maindron, 1903.

### Key to adults of *Cicindela* (*Callytron*) species

1. Elytral maculae reduced to a narrow, continuous lateral band from humeral angle to apical suture ..... 2
  - Elytra immaculate ..... *malabarica* Fleutiaux and Maindron
- 2.(1.) Prosternum glabrous anterior of front coxae; four submarginal labral setae ..... *gyllenhalii* Dejean
  - Prosternum setose anterior of front coxae; eight submarginal labral setae ..... *limosa* Saunders

### *Cicindela* (*Callytron*) *limosa* Saunders

*Cicindela limosa* Saunders, 1836:64, pl. 7, fig. 6.

*Type status*. Syntype(s)? [unexamined; concept based on comparison of its description and illustration with specimens! of each sex from type locality labelled "India, West Bengal, Hooghly River near

Calcutta, IV.1929" at CASS]. *Type depository*. ?BMNH. *Type locality*. "Diamond Harbor, Hooghly" (Hooghly River, West Bengal, India).

*Cicindela cinctella* Chevrolat, 1882:93.

*Type status*. Syntype(s)? [unexamined; synonymy follows Horn (1926)]. *Type depository*. ?MNHN. *Type locality*. "Iles Andaman" (Andaman Islands, India).

*Cicindela nivivinctoides* Horn, 1892a:81.

*Type status*. Holotype, male! [by monotypy]. *Type labels*. "ex coll., Dr. Richter" [typeset within thin black marginal line]; "Type!, Dr. W Horn" [typeset within thin black marginal line]; "Holotypus" [typeset red label]; "Coll. DEI, Eberswalde" [typeset]; "Cicindela, nivivinctoides, W. Horn, seen by R.E. Acciavatti, 1985" [handprinted]; "Cicindela limosa Saunders det. R.E. Acciavatti, 1985" [typeset]. *Type depository*. Holotype at DEI. *Type locality*. "Sud-ost-Asien oder Malaiischer Archipel." (Southeast Asia or Malaysian Archipelago).

*Callytron limosum* (Saunders): Rivalier, 1961:147 (justified emendation).

*Callytron limosa* (Saunders): Naviaux, 1984b:76, fig. 66–68.

**Diagnosis.** — Distinguished by the narrow, continuous lateral band on the elytra; setose prosternum; eight submarginal labral setae.

**Description.** — *General habitus*. Body small (9 mm); dorsum dull green-bronze; head and pronotum with slight copper reflections; very narrow elytral macula along entire lateral margin; body metallic green and copper ventrally. *Head*. Labial palpi with terminal segment metallic and long, exceeding half the length of the testaceous penultimate segment; labrum white, very short and transverse with eight submarginal setae originating almost at middle; frons with numerous fine longitudinal ridges which extend onto vertex where they become wider laterally and form eight to ten mostly complete, moderately raised rugae between each eye and middle, but remain shallow and form an arcuate pattern at middle; frons, vertex and genae glabrous. *Prothorax*. Pronotum quadrate with obtuse posterior angles which are bulging on female, surface finely rugose, glabrous on disc with appressed setae laterally near margin and along anterior reflexed margin; proepisterna with sparse, erect setae; prosternum setose. *Pterothorax*. Female mesepisternal coupling sulcus a deep, sinuate groove along posterior margin deepest ventrally; mesepisterna glabrous, sparse, erect setae on remaining pleura. *Elytra*. Elytral surface finely granulate-punctate throughout, punctures small and purple-green, deepest basally and on some specimens barely contrasting apically; elytra parallel-sided; elytral maculae as a narrow white lateral band from humeral angle to apical spine; female elytra with a smooth, metallic spot medially on basal half; elytral apex with large microsculptations, margin evenly rounded with a long sutural spine on each sex. *Abdomen*. Sterna covered with fine appressed setae, thicker and most abundant laterally. *Legs*. Posterior coxae with fringe of long white setae; trochanters pale testaceous, one subapical seta on each front and middle segment; femora widest at proximal end, metallic green except for pale testaceous distal end; tibiae pale testaceous proximally, metallic green distally; tarsomeres dark brown. *Male genitalia*. Aedeagus long and slender, gradually widening on basal two-thirds and slightly bulky on apical one-third where genitalic capsule is widest, tapering gradually to a long, rounded apex; semisclerotized beak on the right side in left lateral aspect bent to the left.

**Distribution.** — (Fig. 63). India (Orissa, West Bengal, Andhra Pradesh) and Sri Lanka. Ranges eastward into Burma, the Andaman and Nicobar Islands.

**Localities.** — INDIA: West Bengal: Hooghly River near Calcutta, IV.1929 (CASS, CMNH); West Bank Sunderban, 14.IX.1983 (DLPC); Andhra Pradesh: 15 km NW Waltair, 2.VII.1986, brackish mud flat (DLPC). Naviaux (1984b) collected this species on 11.VIII.1979 at Chilaw, Puttalam District, Sri Lanka.

**Ecology.** — Adults are found along the coast and major rivers on brackish mud puddles. They are extremely quick to fly from danger and difficult to see against the dark substrate.

### *Cicindela (Callytron) gyllenhalii* Dejean

*Cicindela gyllenhalii* Dejean, 1825:143.

*Type status*. Syntype(s)? [unexamined; concept based on specimens! labelled "Pakistan, 15 mi (24 km) W Karachi, 10.VII.1975, sandspit," at CMNH]. *Type depository*. ?MNHN. *Type locality*. "Indes Oriental."

*Cicindela gyllenhalii immarginata* Horn, 1892a:81.

*Type status.* Holotype, female! [by monotypy]. *Type labels.* "Ind. Or." [typeset]; "Type!, Dr. W. Horn" [typeset within a thin black marginal line]; "ex coll. Fleutiaux" [handscript lines with red and blue lines on left side of label]; "immarginata" [typeset]; "Coll. DEI, Eberswalde" [typeset]; "HOLOTYPE, *Cicindela, gyllenhalii, immarginata*, W. Horn by monotypy" [typed and handprinted red label]; "*Cicindela (Callytron), gyllenhalii immarginata* W. Horn det. R.E. Acciavatti, '86" [typeset and handprinted]. *Type depository.* Holotype at DEI. *Type locality.* None specified in original description but labelling on holotype indicated "Indes Oriental."

*Cicindela gyllenhalii* Dejean: Fowler, 1912:438, fig. 197.

*Callytron gyllenhalii* (Dejean): Rivalier, 1961:147.

*Diagnosis.* — Distinguished by the narrow, continuous lateral elytral band; glabrous prosternum; four submarginal labral setae.

*Description.* — *General habitus.* Body small (9–9.5 mm); dorsum shiny greenish bronze; elytra marked only with a thin macula along the entire lateral margin; body greenish bronze ventrally. *Head.* Mandibles with four to five teeth distad basal molar, first tooth beyond molar often bifurcated; labrum short, pale, one small acute tooth on each side of broad medial extension; frons finely sculptured; eight to ten mostly complete and broad ridges between each eye and vertex midline; sculpturing fine medially on vertex; eyes flattened and bulging outward; frons, vertex and genae glabrous. *Prothorax.* Pronotum distinctly arcuate along the lateral margin with obtuse posterior angles, entirely glabrous, surface with dense, deep cracks between middle and lateral edge, anterior and posterior transverse sulci shallowly impressed; proespisterna glabrous, smooth; prosternum glabrous. *Pterothorax.* Female mesepisternal coupling sulcus a very broad, sunken area occupying most of surface; all pleura and sterna glabrous. *Elytra.* Female elytral shape subovate, male elytral shape subparallel; surface with dense, small blue-green punctures throughout which join to form narrow, elongate depressions and are associated with broad granulae especially basally and laterally; maculae as a thin white lateral margin from humeral angle to apical spine, some specimens without any evidence of maculae; apex finely microserulate, margin broadly rounded with a retracted apical spine on each sex, more so on female. *Abdomen.* Anterior two sterna glabrous (some specimens with sparse setae at extreme lateral edge), remaining sterna covered with appressed setae which are most abundant laterally. *Legs.* Posterior coxae fringed by long, white setae; trochanters pale nonmetallic, one subapical seta on each front and middle segment; hooked setae along posterior margins of front and middle femora; femora metallic green, pale nonmetallic distal end; tibiae pale basally and metallic green distally; tarsomeres nonmetallic dark brown to green; tarsal claws small. *Male genitalia.* Aedeagus long and moderately slender, enlarging gradually on basal half and widest on apical half which is slightly bulky and tapers abruptly to a blunt apex with a large, semisclerotized beak rounded at the tip and slightly displaced to the right.

*Geographic variation.* — Currently, two subspecies of *Cicindela gyllenhalii* are recognized: *Cicindela gyllenhalii gyllenhalii* with a thin band along the lateral margin; specimens assignable to *C. gyllenhalii immarginata* lack any evidence of a lateral band but we cannot determine if they are only an aberrational form because only the holotype was available for study.

*Distribution.* — (Fig. 63). Coastal Pakistan (Sind) and India (Maharashtra).

*Localities.* — *Cicindela gyllenhalii gyllenhalii.* PAKISTAN: Sind: 15 mi W Karachi, 10.VII.1975, sandspit (FCC, CMNH); Karachi, 8–10.VIII.1982, sandspit (CMNH). *Cicindela gyllenhalii immarginata.* No specific localities are known.

*Ecology.* — Adults typically occur in muddy habitats at or near the seashore. Cassola (1976) reported their abundance on the dry sandy clay layers of a stream bed near the sea with *C. (Hypaetha) copulata*, *C. (Hypaetha) quadrilineata* and *C. (Lophyridia) aulica*.

### *Cicindela (Callytron) malabarica* Fleutiaux and Maindron

*Cicindela malabarica* Fleutiaux and Maindron, 1903:72.

*Type status.* Lectotype, female [here designated]. *Type labels.* "Coll. R.I.Sc.N.B., Inde" [typeset yellow label]; "COTE DE MALABAR, M. MAINDRON, MAHE, Chass. indigenes, Aout 1901"

[typeset label pasted on previous label]; "*Cicindela malabarica* Fleutiaux & Maindron" [handscript]; "Type, Col. Maindron" [handscript]; "Syntype" [typeset red letters]; "LECTOTYPE, *Cicindela malabarica*, Fleutiaux & Maindron, by R.E. Acciavatti, '83" [typed and handprinted red label]. [Lectotype is 8.5 mm; middle legs glued onto body.] Paralectotypes, male! at IRSNB, and five syntypic males! at DEI each here designated and labelled 'PARALECTOTYPE" [typed and handprinted red label]. *Type depository*. Lectotype and paralectotype at IRSNB; five paralectotypes at DEI. *Type locality*. "Mahe" (Kerala, India).

*Cicindela malabarica* Fleutiaux and Maindron: Maindron and Fleutiaux, 1905:14, pl. 1, fig. 5.

*Cicindela malabarica* Fleutiaux and Maindron: Fowler, 1912:438, fig. 196.

*Callytron malabaricum* (Fleutiaux and Maindron): Rivalier, 1961:147 (justified emendation).

### *Diagnosis.*—Distinguished by the immaculate elytra.

*Description.*—*General habitus*. Body small (7.5–9.5 mm); head and pronotum dorsally bronze, laterally shiny blue-green; pronotum with large bulging posterior angles; elytra immaculate, dull bronze almost black; body bronze ventrally. *Head*. Labrum very short, transverse, ivory with dark edges, three extremely small medial teeth (central one longest); 6 submarginal setae, medial four grouped at center; genae, frons and vertex glabrous; eyes small, projecting only laterally; vertex flattened with rugae forming 8 to 10 moderately raised ridges between each eye and vertex midline; rugae shallow and irregular on vertex disc. *Prothorax*. Pronotum subquadrate, entirely glabrous, dorsally with fine, wavy rugae, lateral margin with an abrupt projection at each posterior angle; proepisterna glabrous. *Pterothorax*. Female mesepisternal coupling sulcus a narrow groove, very deep dorsally along posterior margin. *Elytra*. Immaculate; elytral surface densely granulate-punctate throughout; elytral apices separately rounded on both sexes, but more curved on female than male; long, retracted sutural spine on female, short, barely retracted spine on male. *Abdomen*. Sterna with sparse, appressed setae laterally, glabrous medially. *Legs*. Trochanters dark nonmetallic, one subapical seta on each front and middle segment; femora, tibiae and tarsomeres dark, shiny black and metallic bronze. *Male genitalia*. Aedeagus long and moderately slender, enlarging gradually in basal half, widest in apical half which is slightly bulky and tapers gradually to apex; extremely long thin semisclerotized beak bent to the left.

*Distribution.*—(Fig. 63). Western coast of India (Maharashtra, Kerala) and Pakistan (Sind).

*Localities.*—INDIA: Kerala: Mahe, VII. and VII.1901 (DEI); Karnataka: Kumta, 50 m, 12.VI.1987, forest stream edge (DLPC). PAKISTAN: Sind: 40 km E Karachi, 7.VII.1975 (Cassola, 1976).

*Ecology.*—Adults are found in wet muddy habitats at or near the seashore and along coastal rivers and their tributaries.

### DOUBTFUL RECORDS

*Cicindela* (*Myriochile*) *sinica* Fleutiaux, 1889, and *C. (Cosmodela) didyma* Dejean, 1825, were reported by Ghulam-Ullah et al. (1966, 1970) from the regions of Hazara and Swat in northern Pakistan. The presence of these Southeast Asian species in Pakistan would be truly remarkable because no previous worker has ever reported them from any intervening locality. We believe the Pakistan specimens confused with *Cicindela sinica* are probably *C. undulata* because the two species closely resemble each other in lacking a humeral lunule (Fowler, 1912). Furthermore, the latter species is known from adjoining Punjab, India (Pajni and Bedi, 1973). The specimens reported as *Cicindela didyma* are probably *C. intermedia* based on a female! at NMNH with the same collection presented in Ghulam-Ullah et al. (1966).

*Cicindela (Salpingophora) helferi* Schaum, 1863, was reported to possibly occur in Bengal (Heynes-Wood and Dover, 1928). This record is almost certainly in error as the only localities actually reported in the literature (Horn, 1926; Rivalier, 1961) or for specimens! are along the north coast of the Persian Gulf at Bushehr (Bushire) and Bandar (Bender) Abbas, Iran.

*Cicindela (Cosmodela) aurulenta batesi* Fleutiaux, 1893, was listed by Heynes-



Wood and Dover (1928) from Doiphang Valley in Darrang District, Assam, India. This is probably based on misidentified specimens of three other related species: *C. aurulenta*, *virgula* or *fleutiauxi*. Mandl (1975) showed that *Cicindela batesi* is a valid species restricted to Taiwan and often confused with these other species.

*Cicindela (Ifasina) psilica* Bates, 1866, is represented by two specimens! in the IARI Collection, New Delhi. Although the collector, Maya Ram, claimed they were collected in grass on the University of Delhi campus, these specimens were originally found in the IARI Collection unlabelled on pins near other specimens labelled "New Delhi, 7 Nov. 1973." The lack of specimens from intervening areas between New Delhi and the nearest known localities in southern China leads us to question the validity of the New Delhi locality for this species.

*Cicindela (Lophyra) fuliginosa* Dejean, 1826, occurs throughout Southeast Asia and Indonesia, and was considered by Fowler (1912) and Heynes-Wood and Dover (1928) to be represented in Sri Lanka. The origin of this supposition is unclear, but it seems to be unsupported by the facts. This species was not reported by Walther Horn (1904) from Sri Lanka despite his personal travels there in 1899 to collect and examine specimens at the Colombo Museum. Naviaux (1984b, 1986) failed to find this species in recent extensive collecting on Sri Lanka.

2

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Fig. 35.—Political boundaries of the Indian subcontinent. Several border locations between Pakistan and India, and between the People's Republic of China and India are under dispute; therefore, only generalized boundaries are shown as presently adjusted, but these are unofficial and should not be construed to signify universal acceptance or permanency.



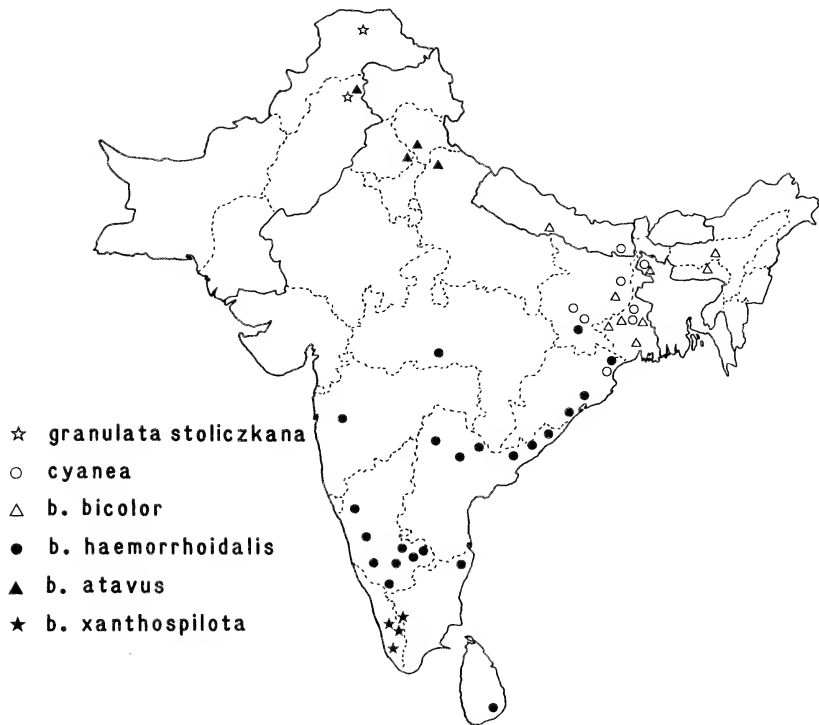


Fig. 36.—Distribution of *Cicindela* (*Cicindela*) *granulata stoliczkana*, *C. (Sophiodela) cyanea*, *C. (Calochroa) bicolor* subspecies on the Indian subcontinent.

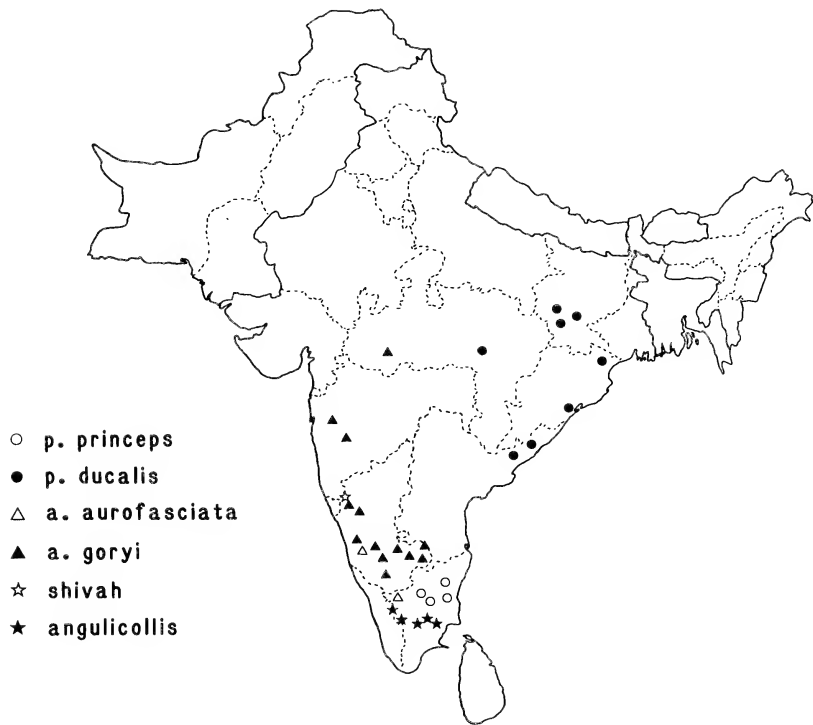


Fig. 37.—Distribution of *Cicindela* (*Pancallia*) *princeps* subspecies, *C. (Pancallia) aurofasciata* subspecies, *C. (Pancallia) shivah*, *C. (Pancallia) angulicollis* on the Indian subcontinent.

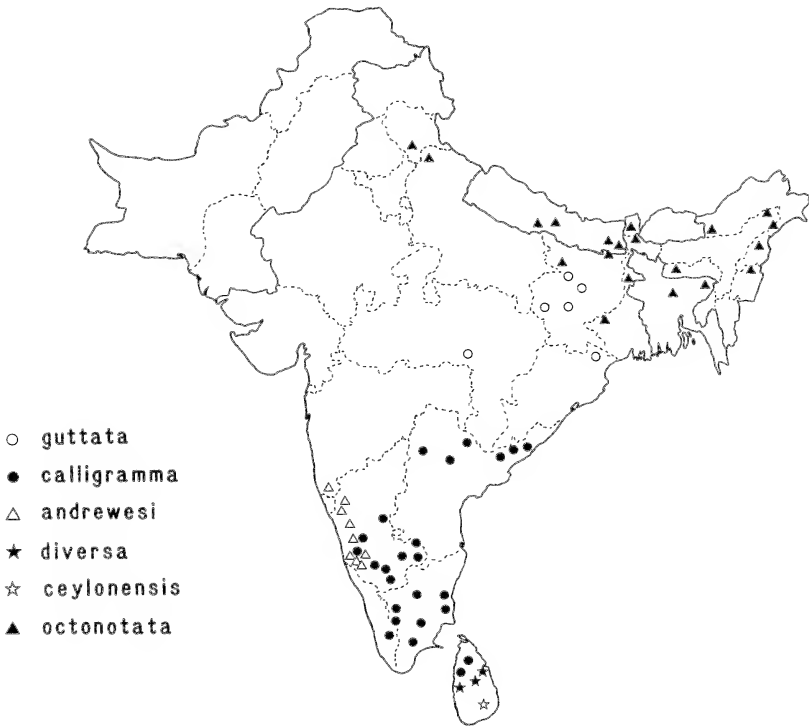


Fig. 38.—Distribution of *Cicindela* (*Ancyliia*) *guttata*, *C. (Ancyliia)* *andrewesi*, *C. (Ancyliia)* *calligramma*, *C. (Ancyliia)* *ceylonensis*, *C. (Ancyliia)* *diversa*, *C. (Calochroa)* *octonotata* on the Indian subcontinent.

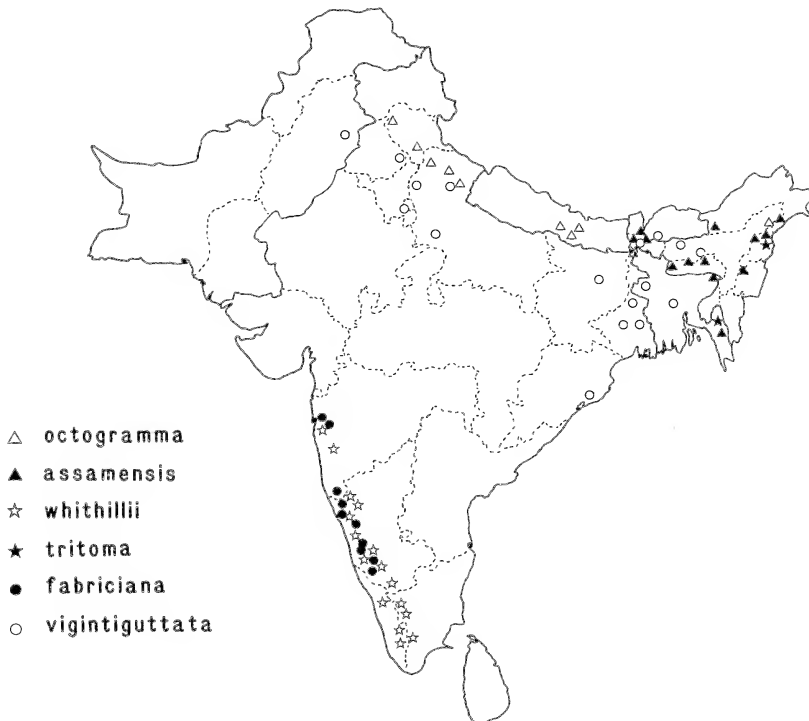


Fig. 39.—Distribution of *Cicindela* (*Calochroa*) *octogramma*, *C. (Calochroa)* *assamensis*, *C. (Calochroa)* *whithillii*, *C. (Calochroa)* *tritoma*, *C. (Calochroa)* *fabriciana*, *C. (Chaetodera)* *vigintiguttata* on the Indian subcontinent.



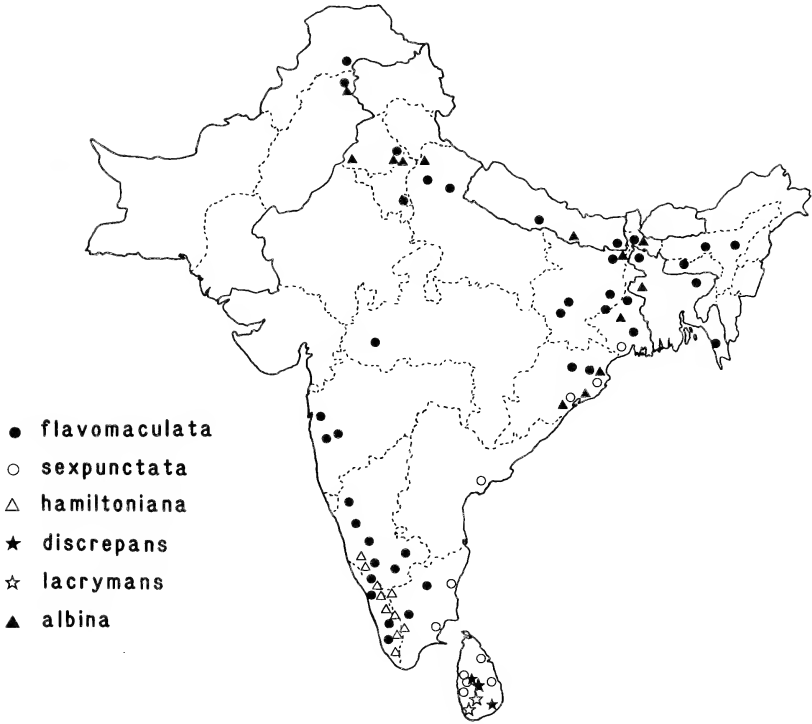


Fig. 40.—Distribution of *Cicindela* (*Calochroa*) *flavomaculata*, *C. (Calochroa) sexpunctata*, *C. (Calochroa) hamiltoniana*, *C. (Calochroa) discrepans*, *C. (Calochroa) lacrymans*, *C. (Chaetodera) albina* on the Indian subcontinent.

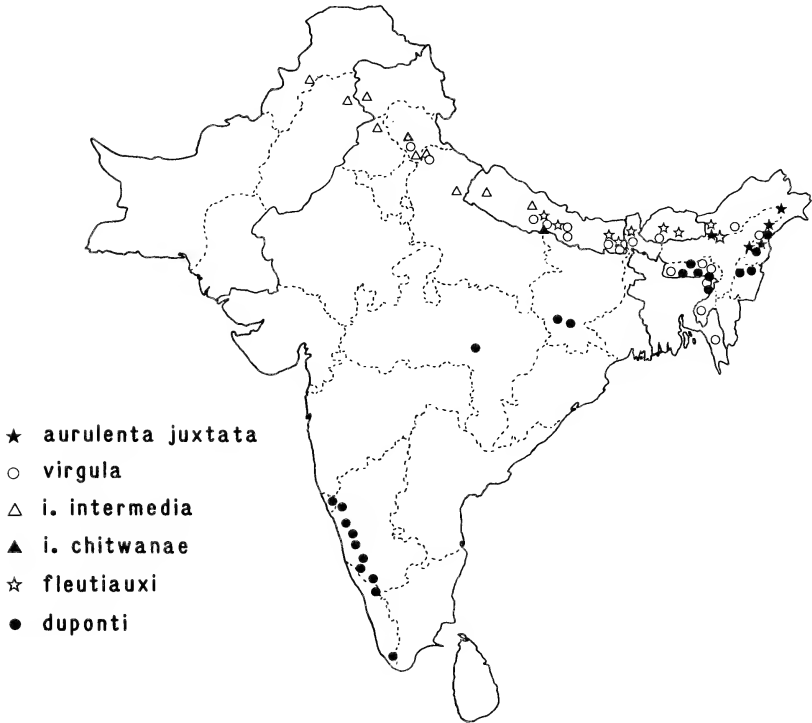


Fig. 41.—Distribution of *Cicindela* (*Cosmodela*) *aurulenta juxtata*, *C. (Cosmodela) virgula*, *C. (Cosmodela) intermedia* subspecies, *C. (Cosmodela) fleutiauxi*, *C. (Cosmodela) duponti* on the Indian subcontinent.

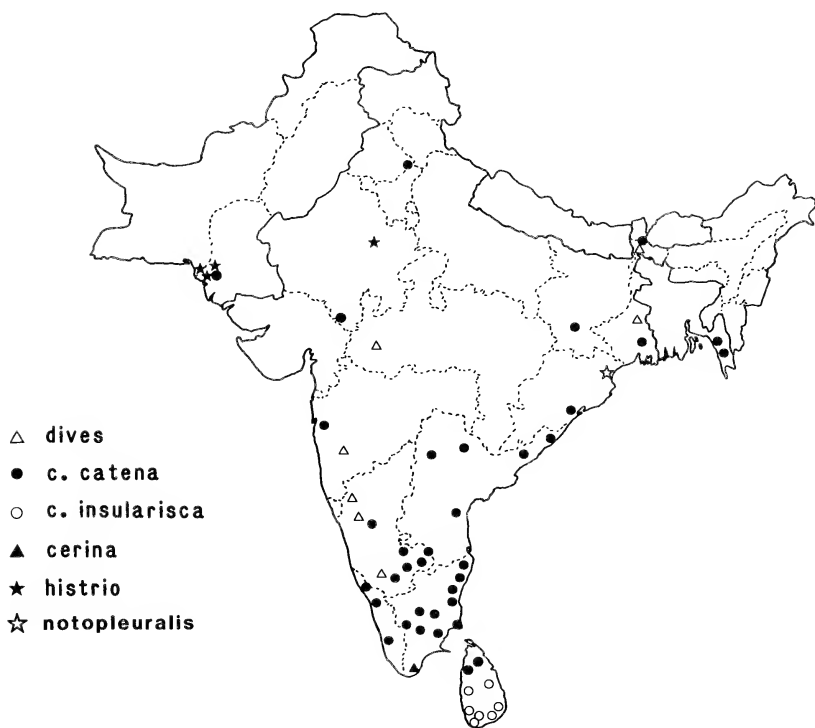


Fig. 42.—Distribution of *Cicindela* (*Plutacia*) *dives*, *C. (Lophyra)* *catena* subspecies, *C. (Lophyra)* *cerina*, *C. (Lophyra)* *histrio*, *C. (Plutacia)* *notopleuralis* on the Indian subcontinent.

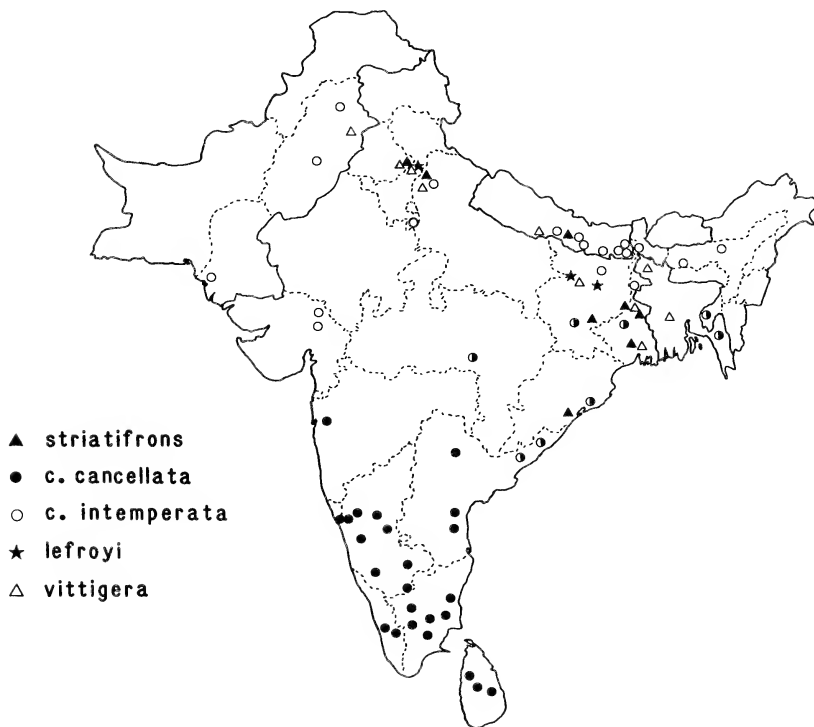


Fig. 43.—Distribution of *Cicindela* (*Lophyra*) *striatifrons*, *C. (Lophyra)* *cancellata* subspecies, *C. (Spilodia)* *lefroyi*, *C. (Spilodia)* *vittigera* on the Indian subcontinent.

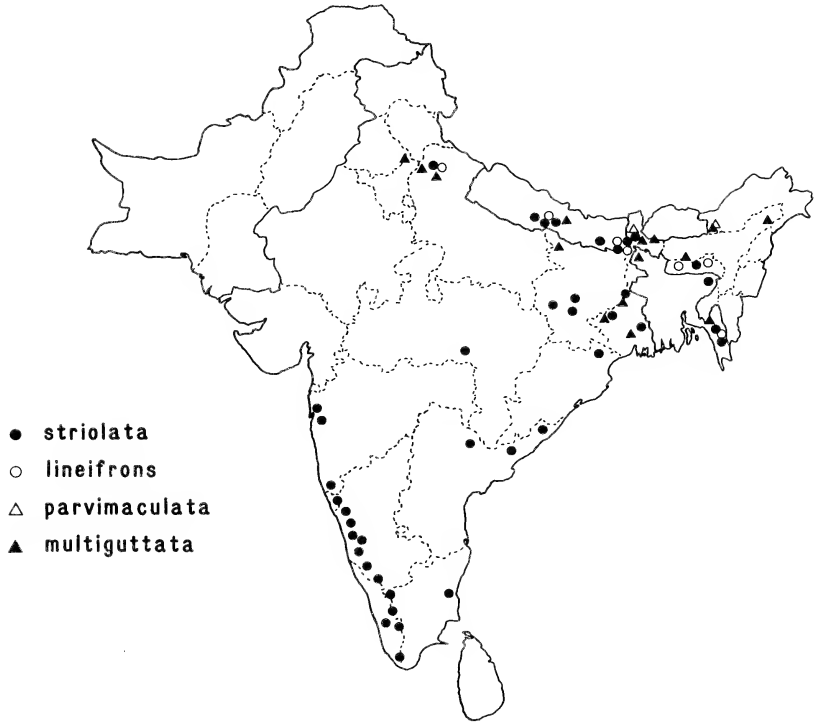


Fig. 44.—Distribution of *Cicindela (Spilodia) striolata*, *C. (Spilodia) lineifrons*, *C. (Spilodia) parvimaculata*, *C. (Spilodia) multiguttata* on the Indian subcontinent.

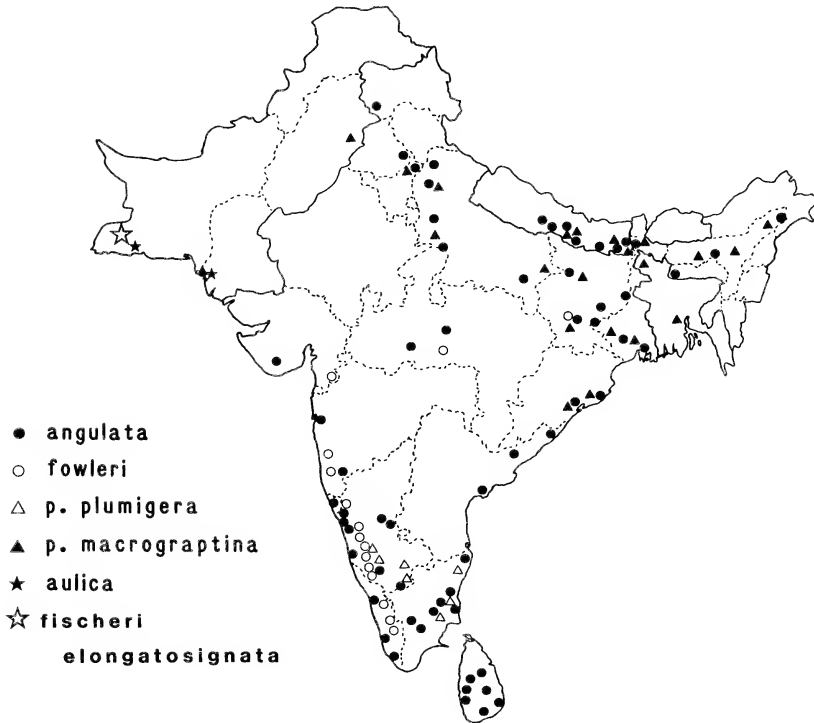


Fig. 45.—Distribution of *Cicindela (Lophyridia) angulata*, *C. (Lophyridia) fowleri*, *C. (Lophyridia) plumigera* subspecies, *C. (Lophyridia) aulica*, *C. (Lophyridia) fischeri elongatosignata* on the Indian subcontinent.

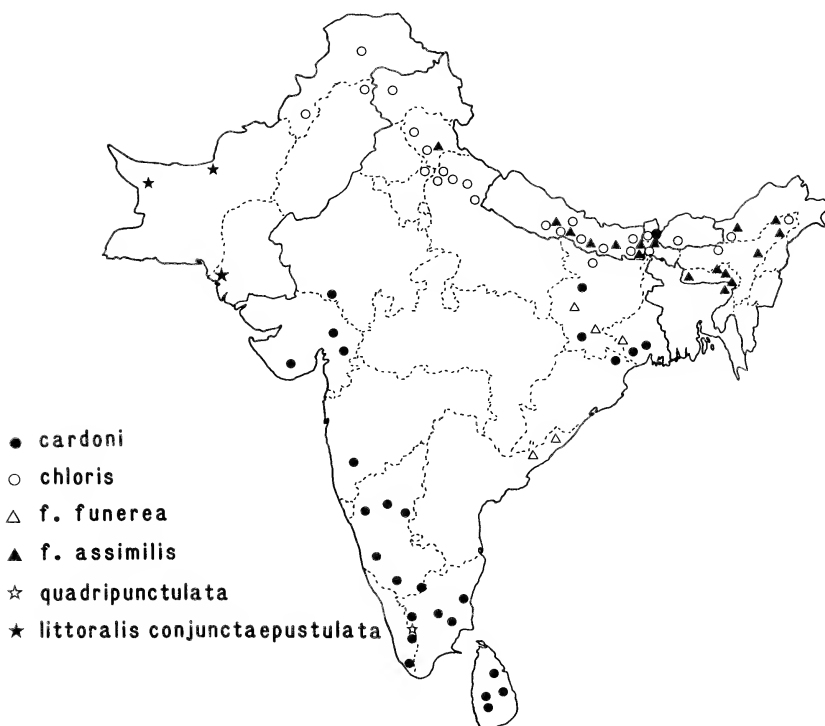


Fig. 46.—Distribution of *Cicindela* (*Lophyridia*) *cardoni*, *C. (Lophyridia)* *chloris*, *C. (Lophyridia)* *funerea* subspecies, *C. (Lophyridia)* *quadripunctulata*, *C. (Lophyridia)* *littoralis conjunctaepustulata* on the Indian subcontinent.

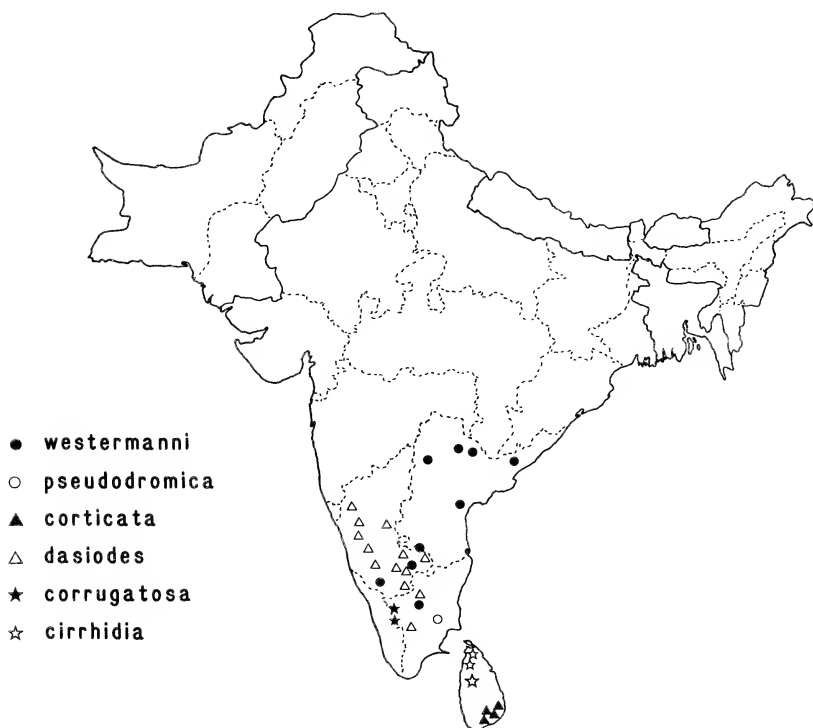


Fig. 47.—Distribution of *Cicindela* (*Jansenia*) *westermanni*, *C. (Jansenia)* *pseudodromica*, *C. (Jansenia)* *corticata*, *C. (Jansenia)* *dasiodes*, *C. (Jansenia)* *corrugatos*, *C. (Jansenia)* *cirrhidia* on the Indian subcontinent.

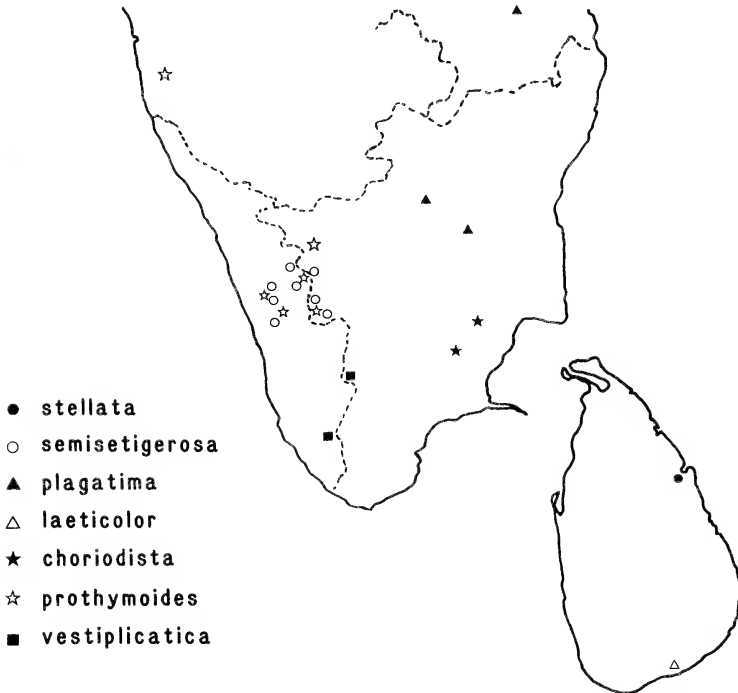


Fig. 48.—Distribution of *Cicindela* (*Jansenia*) *stellata*, *C. (Jansenia)* *semisetigerosa*, *C. (Jansenia)* *plagatima*, *C. (Jansenia)* *laeticolor*, *C. (Jansenia)* *chorioidista*, *C. (Jansenia)* *prothymoides*, *C. (Jansenia)* *vestiplicatica* on the Indian subcontinent.

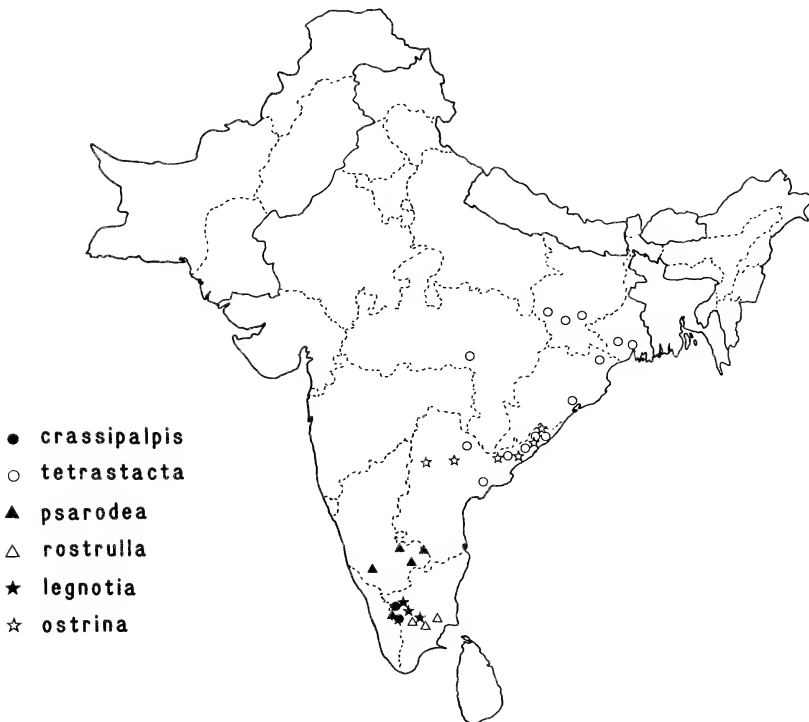


Fig. 49.—Distribution of *Cicindela* (*Jansenia*) *crassipalpis*, *C. (Jansenia)* *tetrastacta*, *C. (Jansenia)* *psarodea*, *C. (Jansenia)* *rostrulla*, *C. (Jansenia)* *legnotia*, *C. (Jansenia)* *ostrina* on the Indian subcontinent.

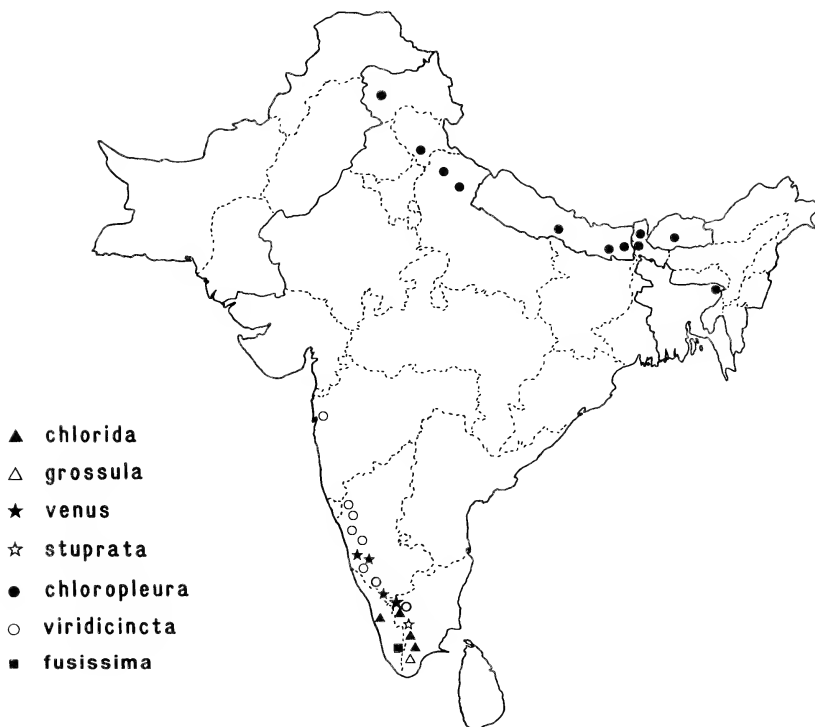


Fig. 50.—Distribution of *Cicindela (Jansenia) chlorida*, *C. (Jansenia) grossula*, *C. (Jansenia) venus*, *C. (Jansenia) stuprata*, *C. (Jansenia) chloropleura*, *C. (Jansenia) viridicincta*, *C. (Jansenia) fusissima* on the Indian subcontinent.

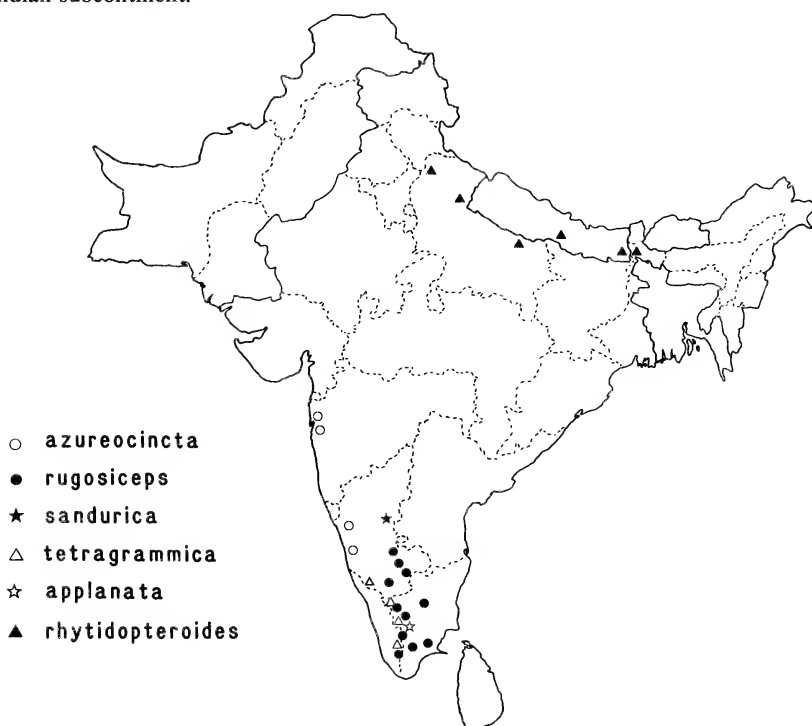


Fig. 51.—Distribution of *Cicindela (Jansenia) azureocincta*, *C. (Jansenia) rugosiceps*, *C. (Jansenia) sandurica*, *C. (Jansenia) tetragrammica*, *C. (Jansenia) applanata*, *C. (Setinteridenta) rhytidopteroides* on the Indian subcontinent.



Fig. 52.—Distribution of *Cicindela* (*Jansenia*) *motschulskyana*, *C. (Oligoma)* *paradoxa*, *C. (Oligoma)* *lacunosa*, *C. (Cylindera)* *descendens*, *C. (Cylindera)* *armandi*, *C. (Ifasina)* *foveolata* on the Indian subcontinent.

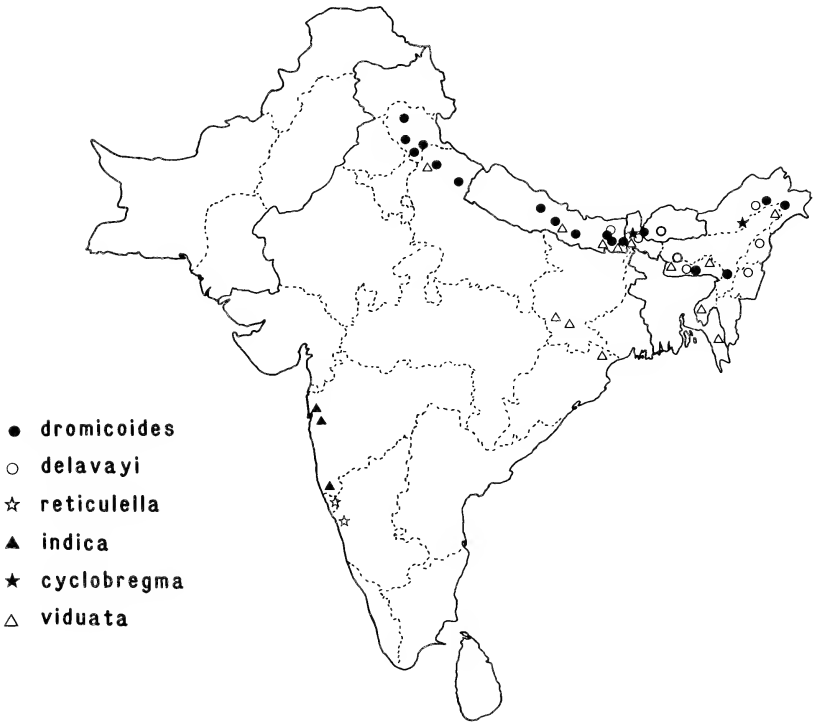


Fig. 53.—Distribution of *Cicindela* (*Cylindera*) *dromicoides*, *C. (Cylindera)* *delavayi*, *C. (Jansenia)* *reticulella*, *C. (Jansensia)* *indica*, *C. (Ifasina)* *cyclobregma*, *C. (Ifasina)* *viduata* on the Indian subcontinent.



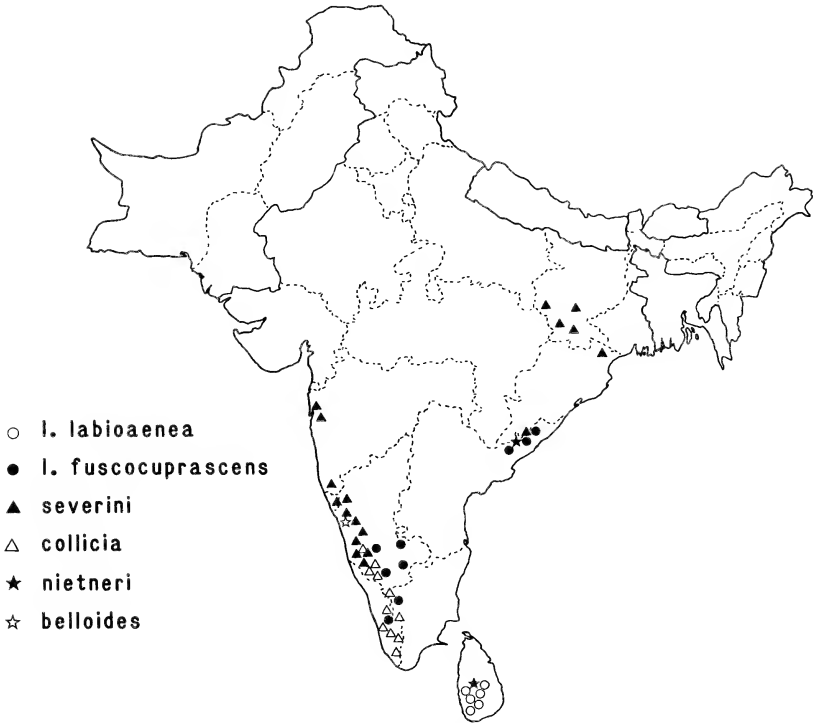


Fig. 54.—Distribution of *Cicindela (Ifasina) labioaenea* subspecies, *C. (Ifasina) severini*, *C. (Ifasina) collicia*, *C. (Ifasina) nietneri*, *C. (Glomera) belloides* on the Indian subcontinent.

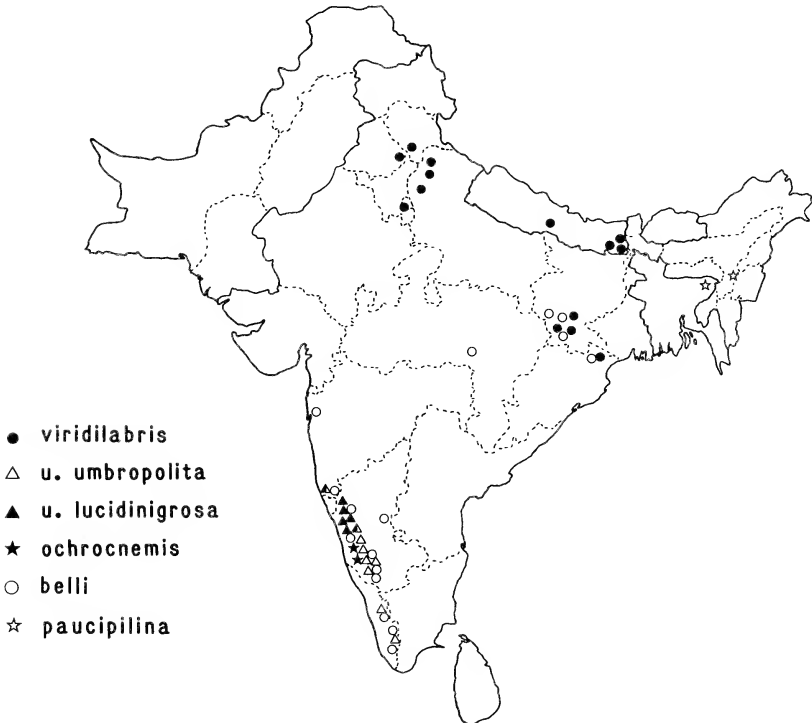


Fig. 55.—Distribution of *Cicindela (Ifasina) viridilabris*, *C. (Ifasina) umbropolita* subspecies, *C. (Glomera) ochrocnemis*, *C. (Ifasina) belli*, *C. (Ifasina) paucipilina* on the Indian subcontinent.

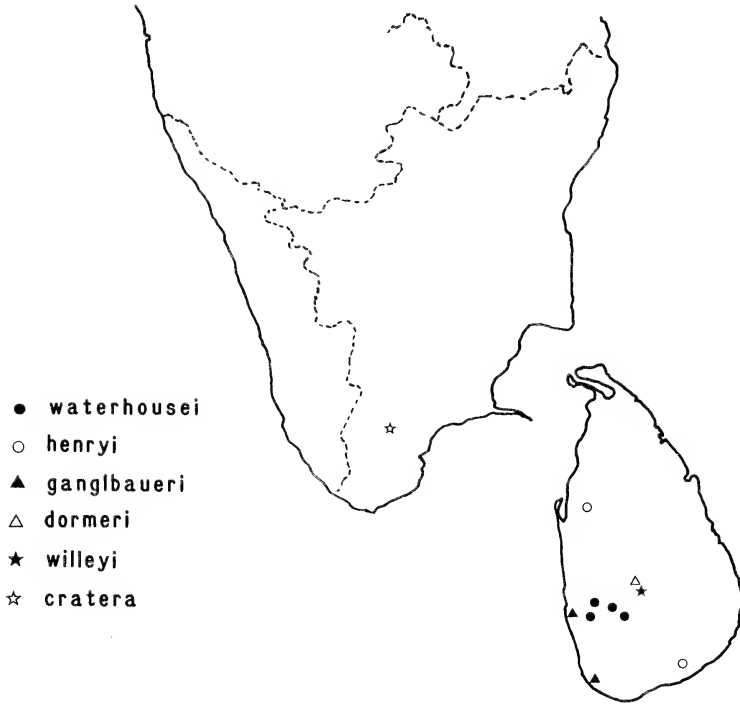


Fig. 56.—Distribution of *Cicindela (Ifasina) waterhousei*, *C. (Ifasina) henryi*, *C. (Ifasina) ganglbaueri*, *C. (Ifasina) dormeri*, *C. (Ifasina) willeyi*, *C. (Jansenia) cratera* on the Indian subcontinent.

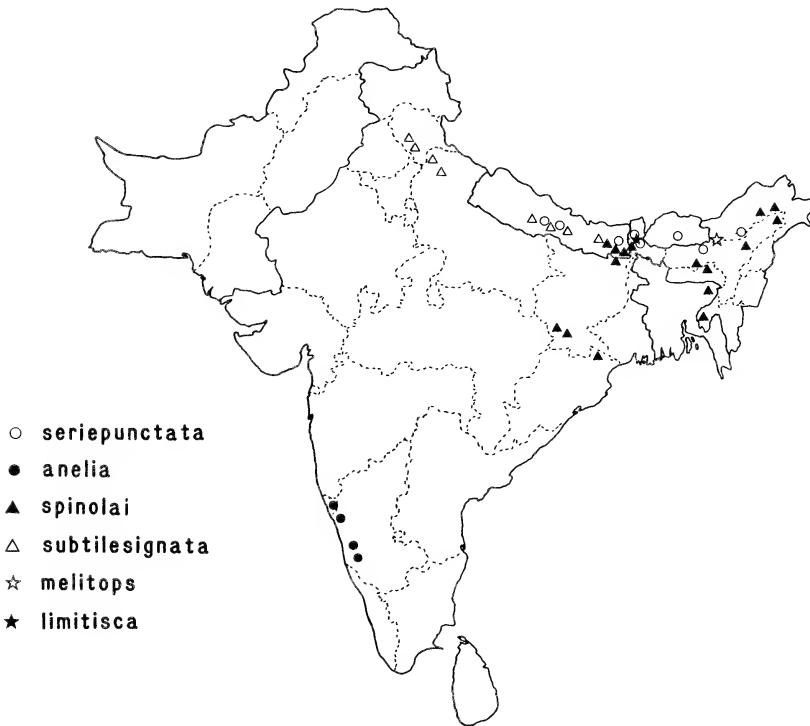


Fig. 57.—Distribution of *Cicindela (Ifasina) seriepunctata*, *C. (Ifasina) anelia*, *C. (Ifasina) spinolai*, *C. (Ifasina) subtilesignata*, *C. (Ifasina) melitops*, *C. (Ifasina) limitisca* on the Indian subcontinent.

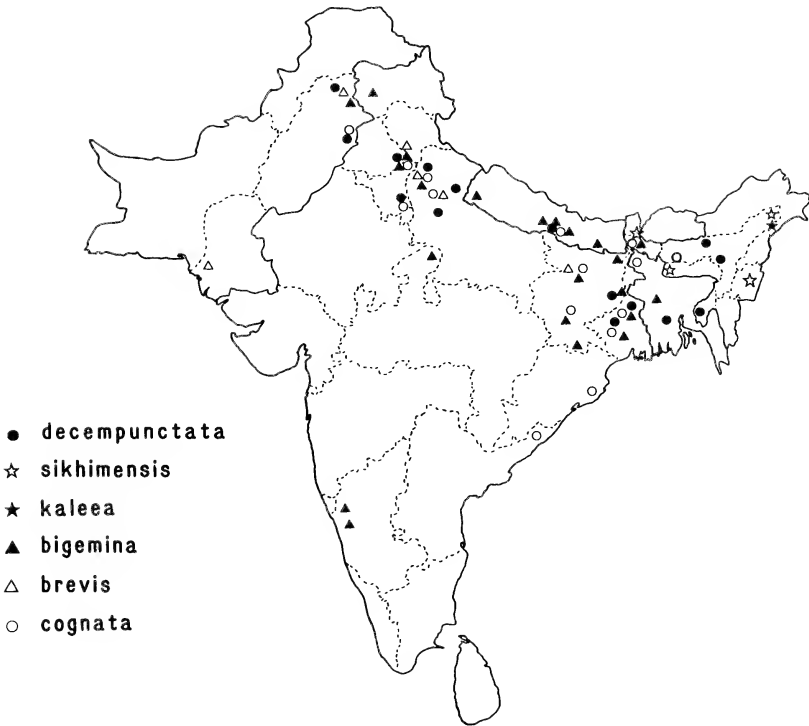


Fig. 58.—Distribution of *Cicindela (Ifasina) decempunctata*, *C. (Ifasina) sikhimensis*, *C. (Ifasina) kaleea*, *C. (Eugrapha) bigemina*, *C. (Eugrapha) brevis*, *C. (Eugrapha) cognata* on the Indian subcontinent.

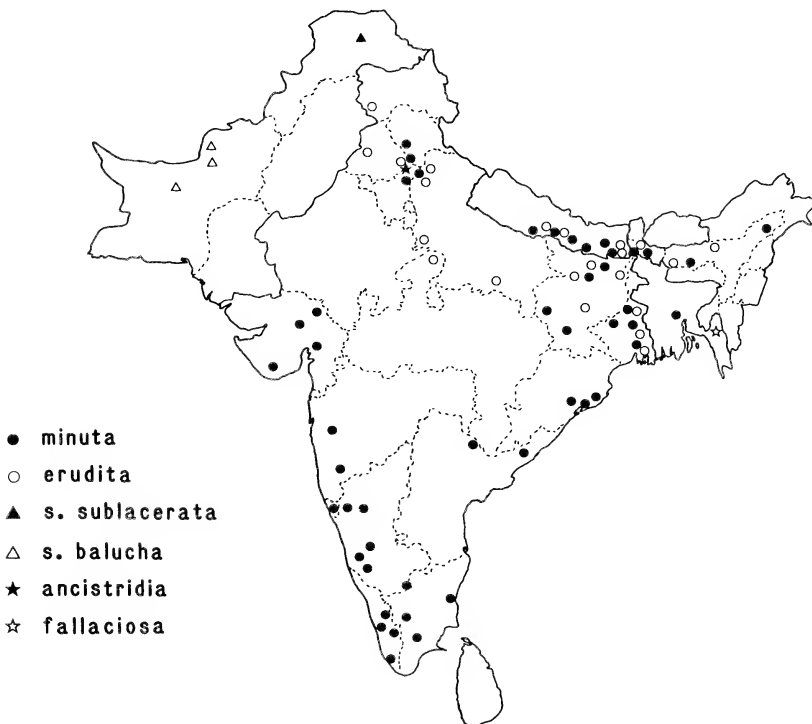


Fig. 59.—Distribution of *Cicindela (Eugrapha) minuta*, *C. (Eugrapha) erudita*, *C. (Eugrapha) sublacerata* subspecies, *C. (Eugrapha) ancistridia*, *C. (Ifasina) fallaciosa* on the Indian subcontinent.

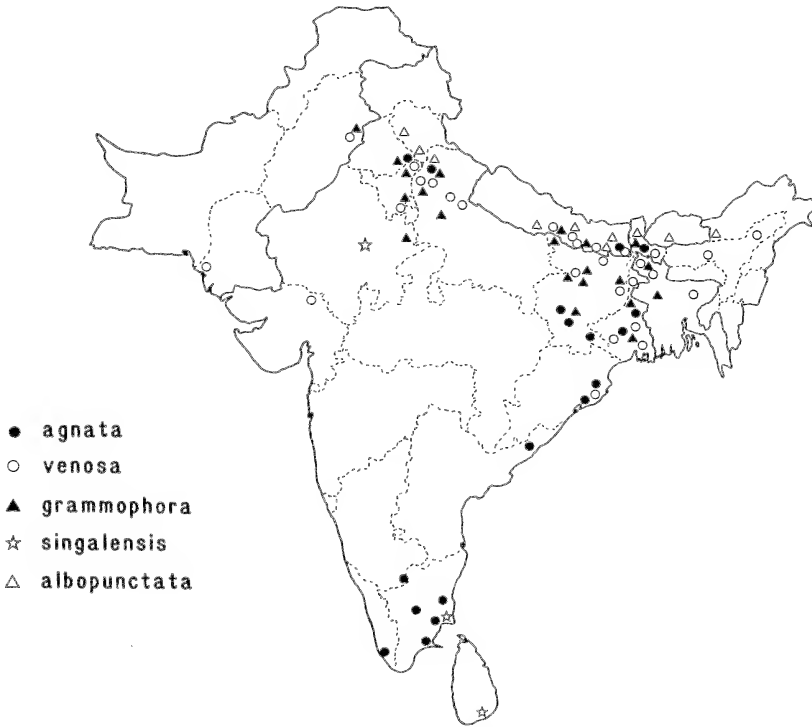


Fig. 60.—Distribution of *Cicindela* (*Eugrapha*) *agnata*, *C. (Eugrapha) venosa*, *C. (Eugrapha) grammophora*, *C. (Eugrapha) singalensis*, *C. (Eriodera) albopunctata* on the Indian subcontinent.

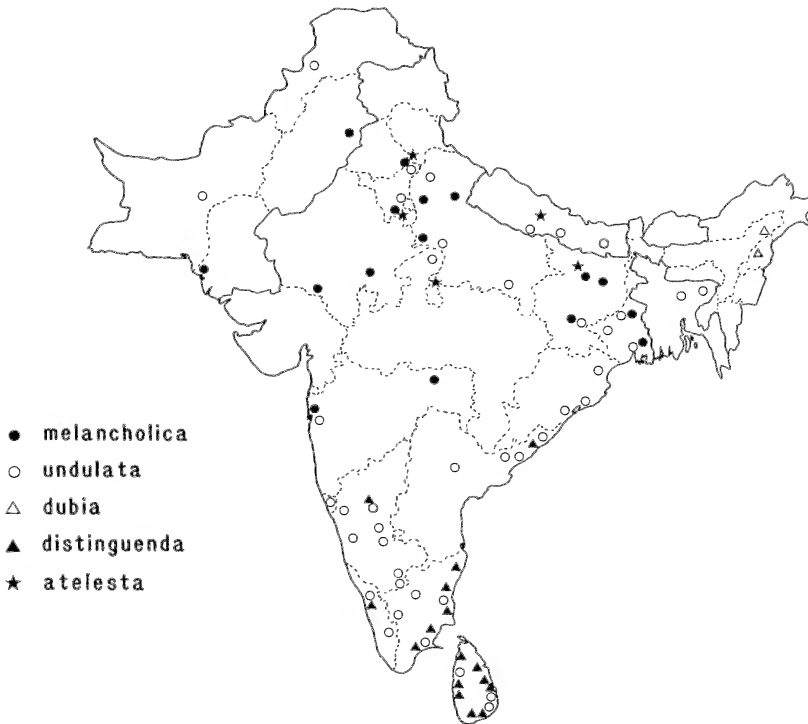


Fig. 61.—Distribution of *Cicindela* (*Myriochile*) *melancholica*, *C. (Myriochile) undulata*, *C. (Myriochile) dubia*, *C. (Myriochile) distinguenda*, *C. (Myriochile) atelesta* on the Indian subcontinent.

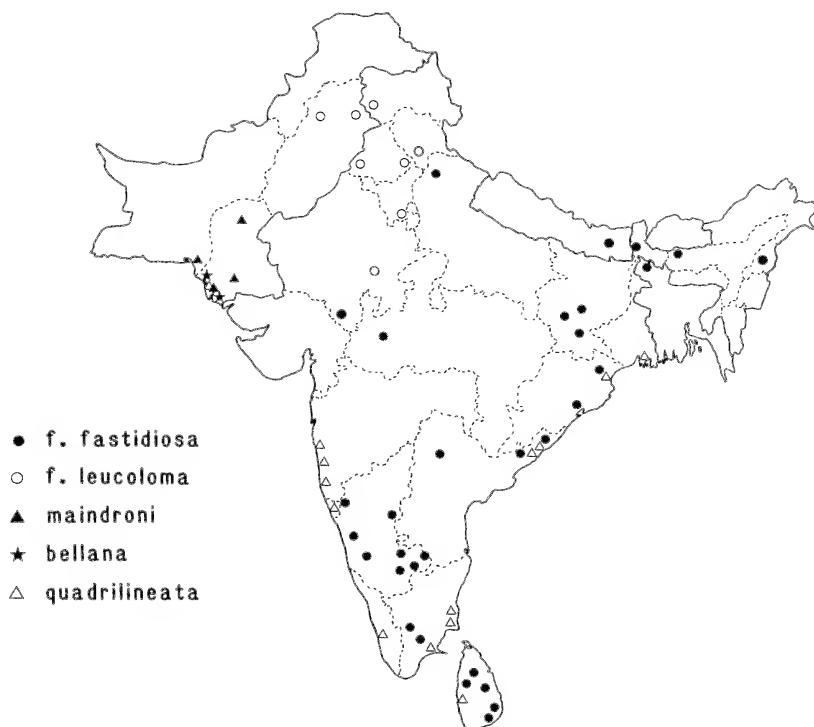


Fig. 62.—Distribution of *Cicindela* (*Monelica*) *fastidiosa* subspecies, *C. (Salpingophora) maindroni*, *C. (Salpingophora) bellana*, *C. (Hypaetha) quadrilineata* on the Indian subcontinent.



Fig. 63.—Distribution of *Cicindela* (*Hypaetha*) *biramosa*, *C. (Hypaetha) copulata*, *C. (Hypaetha) ornatipennis*, *C. (Callytron) limosa*, *C. (Callytron) gyllenhalii*, *C. (Callytron) malabarica* in the Indian subcontinent.

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# INDEX TO TAXA (synonyms in *italics*)

## GENERA AND SUBGENERA

*Achemenia* Rivalier 322  
*Ancylia* Rivalier 109  
*Apteroessa* Hope 91  
*Callytron* Gistl 322  
*Calochroa* Hope 115  
*Calochroma* Motschulsky 115  
*Calomera* Motschulsky 156  
*Calostola* Motschulsky 115  
*Catoptria* Guérin-Ménéville 307  
*Chaetodera* Jeannel 139  
*Chaetostyla* Ganglbauer 142  
*Cicindela* Linnaeus 91, 101  
*Cosmodela* Rivalier 130  
*Cylindera* Westwood 240  
*Dromica* Dejean 171  
*Eriodera* Rivalier 303  
*Eugrapha* Rivalier 285  
*Euryoda* Lacordaire 180  
*Glomera*, new subgenus 233  
*Heptodonta* Hope 91  
*Hypaetha* LeConte 317  
*Ifasina* Jeannel 245  
*Jansenia* Chaudoir 171  
*Jansonina* Bates 171  
*Lophyra* Motschulsky 142  
*Lophyridia* Jeannel 156  
*Lutaria* Horn 307  
*Monelica* Rivalier 305  
*Myriochila* Motschulsky 307  
*Myriochile* Motschulsky 307  
*Oligoma* Rivalier 238  
*Pancallia* Rivalier 104  
*Parmecus* Motschulsky 243  
*Plutacia* Rivalier 137  
*Prothyma* Hope 91  
*Pseudochaetodera* Pajni and Bedi 139  
*Rhytidophaena* Bates 91  
*Rivaliera* Pajni and Bedi 139  
*Salpingophora* Rivalier 314  
*Sericina* Rivalier 102  
*Setinteridenta* Acciavatti 237  
*Sophiodela* Nakane 102  
*Spilodia* Rivalier 149  
*Tetreurytarsa* Horn 210  
*Therates* Latreille 91  
*Thopeutica* Schaum 220

## SPECIES AND SUBSPECIES WITH SUBGENERA

*acuminata* Kollar, *Eugrapha* 291  
*aegyptiaca* Dejean, *Myriochile* 307

*agnata* Fleutiaux, *Eugrapha* 295  
*salbida* Dejean, *Chaetodera* 140  
*albina* Wiedemann, *Chaetodera* 140  
*albopunctata* Chaudoir, *Eriodera* 304  
*albovittata* (Naviaux), *Ifasina* 279  
*amabilis* Dejean, *Eugrapha* 294  
*ancistridia*, new species, *Eugrapha* 296  
*andrewesi* (Horn), *Ancylia* 110  
*anelia*, new species, *Ifasina* 281  
*angulata* Dejean, *Lophyridia* 160  
*angulata* Fabricius, *Lophyridia* 157  
*angulicollis* Horn, *Pancallia* 107  
*applanata*, new species, *Jansenia* 231  
*arcuata* Kollar, *Lophyridia* 157  
*armandi* Fairmaire, *Cylindera* 242  
*assamensis* Parry, *Calochroa* 122  
*assimilis* Hope, *Lophyridia* 164  
*atavus* Horn, *Calochroa* 126  
*atelesta* Chaudoir, *Myriochile* 311  
*atricolor* Mandl, *Ancylia* 111  
*atroptera* Mandl, *Eugrapha* 298  
*aulica* Dejean, *Lophyridia* 169  
*aurofasciata* Dejean, *Pancallia* 105  
*aurovittata* Audouin and Brullé, *Calochroa* 119  
*aurulenta* Fabricius, *Cosmodela* 130  
*azureocincta* Bates, *Jansenia* 222  
*baltimorensis* Herbst, *Eugrapha* 291  
*balucha* Bates, *Eugrapha* 302  
*barmanica* Gestro, *Cosmodela* 136  
*batesi* Fleutiaux, *Cosmodela* 325  
*bellana* Horn, *Salpingophora* 316  
*belli* Horn, *Ifasina* 263  
*belloides* (Horn), *Glomera* 234  
*bicolor* Fabricius, *Calochroa* 125  
*bigemina* Klug, *Eugrapha* 287  
*biprolongata* Horn, *Eugrapha* 296  
*biramosa* Fabricius, *Hypaetha* 319  
*boyeri* Blanchard, *Lophyridia* 158  
*brevis* Horn, *Eugrapha* 288  
*calligramma* Schaum, *Ancylia* 112  
*campestris* Linnaeus, *Cicindela* 101  
*cancellata* Dejean, *Lophyra* 147  
*cardoni* Fleutiaux, *Lophyridia* 163  
*catena* Fabricius, *Lophyra* 143  
*cerina* (Naviaux and Acciavatti), *Lophyra* 145  
*ceylonensis* Horn, *Ancylia* 113  
*chinensis* Geer, *Sophiodela* 102  
*chitwanae*, new subspecies, *Cosmodela* 134  
*chloe* Dokhtoureff, *Jansenia* 220  
*chlorida*, Chaudoir, *Jansenia* 211  
*chloris* Hope, *Lophyridia* 164  
*chlorochila* Chaudoir, *Ifasina* 253  
*chloropleura* Chaudoir, *Jansenia* 220  
*chloropus* Audouin and Brullé, *Eugrapha* 294  
*choriodista*, new species, *Jansenia* 206  
*cinctella* Chevrolat, *Callytron* 323  
*cirrhidia*, new species, *Jansenia* 201

- coeruleolabris* Mandl, Jansenia 220  
*cognata* Wiedemann, Eugrapha 292  
*collicia*, new species, Ifasina 259  
*colon* Klug, Jansenia 210  
*confluens* Fowler, Ancyilia 112  
*conjunctaepustulata* Dokhtouff, Lophyridia 168  
*contracta* Fleutiaux, Hypaetha 319  
*copulata* Schmidt-Goebel, Hypaetha 320  
*corrugatosus*, new species, Jansenia 196  
*corticata* (Putzeys), Jansenia 180  
*crassipalpis* Horn, Jansenia 209  
*cratera*, new species, Jansenia 198  
*crucigera* (Hope), Pancallia 106  
*cyanea* Fabricius, Sophiodela 103  
*cyclobregma*, new species, Ifasina 251  
  
*dasiodes*, new species, Jansenia 181  
*decemguttata* Fabricius, Lophyridia 156  
*decempunctata* Dejean, Ifasina 280  
*dejeanii* Hope, Sophiodela 103  
*delavayi* Fairmaire, Cyllindera 244  
*descendens* Fischer, Cyllindera 241  
*despecta* Fleutiaux, Myriochile 305  
*didyma* Dejean, Cosmodela 325  
*dilata* Fleutiaux, Hypaetha 319  
*discrepans* Walker, Calochroa 128  
*discreta* Schaum, Ifasina 284  
*disjuncta* Dejean, Ifasina 245  
*dissimilis* Peringuey, Eugrapha 302  
*distinguenda* Dejean, Myriochile 313  
*diversa* Horn, Ancyilia 114  
*dives* Gory, Plutacia 138  
*dohrnii* (Motschulsky), Myriochile 313  
*dolens* Fleutiaux, Cyllindera 244  
*dongalensis* Klug, Lophyridia 156  
*dormeri* Horn, Ifasina 267  
*dorsolineolata* Chevrolat, Spilodia 150  
*dromicoides* Chaudoir, Cyllindera 243  
*dubia* Horn, Myriochile 310  
*ducalis* Horn, Pancallia 104  
*duponti* Dejean, Cosmodela 136  
  
*eberti* Mandl, Eugrapha 305  
*elongatosignata* Horn, Lophyridia 167  
*erudita* Wiedemann, Eugrapha 294  
  
*fabriciana* Horn, Calochroa 124  
*fabricii* (Horn), Calochroa 124  
*fabrici* Beuthin, Calochroa 124  
*fallaciosa* Horn, Ifasina 257  
*fallax* Coquerel, Ifasina 245  
*fastidiosa* Dejean, Monelica 305  
*ferriei* Fleutiaux, Cicindela 134  
*fischeri* Adams, Lophyridia 167  
*flavoguttata* (Horn), Ancyilia 111  
*flavomaculata* Chevrolat, Cosmodela 131  
*flavomaculata* Hope, Calochroa 117  
*flavopunctata* Audouin, Calochroa 126  
*flavovittata* Chaudoir, Calochroa 127  
*fleutiauxi* Horn, Cosmodela 134  
*foveolata* Schaum, Ifasina 250  
  
*fowleri* Heynes-Wood and Dover, Lophyridia 159  
*fuliginosa* Dejean, Lophyra 326  
*funebri* Schmidt-Goebel, Cyllindera 244  
*funerea* MacLeay, Lophyridia 166  
*fuscocuprascens* Horn, Ifasina 256  
*fusissima*, new species, Jansenia 218  
  
*ganglbaueri* Horn, Ifasina 266  
*germanica* Linnaeus, Cyllindera 240  
*goryi* Chaudoir, Pancallia 106  
*grammophora* Chaudoir, Eugrapha 300  
*granulata* Gebler, Cicindela 101  
*grossula* Horn, Jansenia 216  
*guttata* Wiedemann, Ancyilia 109  
*gyllenhalii* Dejean, Callytron 323  
  
*haemorrhoidalis* Wiedemann, Calochroa 125  
*hamiltoniana* Thomson, Calochroa 127  
*helferi* Schaum, Salpingophora 325  
*henryi* Horn, Ifasina 268  
*himaleyica* Redtenbacher, Lophyridia 164  
*histrio* Tschitscherine, Lophyra 146  
*holosericea* Fabricius, Ifasina 253, 254  
*horsfieldii* Thomson, Calochroa 122  
  
*immarginata* Horn, Callytron 324  
*imperfecta* Chaudoir, Myriochile 311  
*imperfecta* Horn, Lophyridia 159  
*imperfectula* Horn, Lophyridia 159  
*indica* Fleutiaux, Cosmodela 136  
*indica* Fleutiaux, Jansenia 226  
*insularis* Blanchard, Lophyra 143  
*insularis* Naviaux, Lophyra 143  
*insularisca*, new name, Lophyra 143  
*intemperata*, new name, Lophyra 147  
*intermedia* Chaudoir, Cosmodela 133  
*interrupta* Fleutiaux, Spilodia 151  
*iravaddica* Gestro, Eugrapha 288  
  
*japonica* Thunberg, Sophiodela 102  
*juliae* Ballion, Cyllindera 241  
*juxtata*, new name, Calochroa 131  
  
*kaleea* Bates, Ifasina 284  
*kasyi* Mandl, Cosmodela 133  
*kirilovii* Fischer, Cyllindera 241  
*kraatzi* Dokhtouff, Cicindela 112  
*kraatzi* (Horn), Ancyilia 112  
  
*labioaenea* Horn, Ifasina 256  
*labionigra* Mandl, Calochroa 123  
*lacrymans* Schaum, Calochroa 129  
*lacrymosa* Dejean, Lophyridia 143  
*lacunosa* Putzeys, Oligoma 239  
*laeticolor* Horn, Jansenia 205  
*latefasciata* Mandl, Pancallia 106  
*latipennis* Parry, Lophyridia 160  
*lefroyi* Horn, Spilodia 153  
*legnotia*, new species, Jansenia 190  
*leguilloui* Guérin-Méneville, Lophyridia 158  
*lepida* Gory, Pancallia 106  
*leucoloma* Chaudoir, Myriochile 305  
*limitisca*, new species, Ifasina 276

- limosa* Saunders, Callytron 322  
*limosum* (Saunders), Callytron 323  
*lineifrons* Chaudoir, Spilodia 151  
*litigiosa* Dejean, Myriochile 305  
*littoralis* Fabricius, Lophyridia 168  
*lobbichleri* Mandl, Lophyridia 164  
*loeffleri* Mandl, Cosmodela 135  
*lucidinigrosa*, new subspecies, Ifasina 265  
*lunatula* Horn, Myriochile 313  
*lunulata* Fabricius, Lophyridia 169  
*macrograptina*, new subspecies, Lophyridia 162  
*maindroni* Horn, Salpingophora 315  
*malabarica* Fleutiaux and Maindron, Callytron 324  
*malabaricum* (Fleutiaux and Maindron), Callytron 325  
*marginipunctata* Dejean, Lophyridia 166  
*mauritiu* Horn, Ancyilia 111  
*melancholica* Fabricius, Myriochile 308  
*melitops*, new species, Ifasina 271  
*millingeni* Bates, Hypaetha 319  
*minuta* Olivier, Eugrapha 291  
*modica* Gestro, Ifasina 281  
*monalisa* Horn, Callytron 322  
*motschoulskyi* Horn, Jansenia 225  
*motschulskyana* Horn, Jansenia 225  
*multiguttata* Dejean, Spilodia 155  
*mutata* Fleutiaux, Eugrapha 293  
*myrrha* Thomson, Ifasina 254  
*nathanae* Mandl and Wiesner, Ifasina 258  
*nepalensis* Mandl, Myriochile 312  
*nietneri* Horn, Ifasina 262  
*nitida* Wiedemann, Eugrapha 298  
*nivicinctoides* Horn, Callytron 323  
*notopleuralis* Acciavatti and Cassola, Plutacia 138  
*nuda* Horn, Salpingophora 316  
*oberthuri* Fleutiaux, Cosmodela 134  
*obliquevittata* Fleutiaux, Sophiodela 103  
*obscuridilatata* Horn, Ifasina 280  
*ochrocnemis*, new species, Glomera 235  
*octogramma* Chaudoir, Calochroa 123  
*octonotata* Wiedemann, Calochroa 116  
*olivia* Bates, Eugrapha 304  
*ornata* Fleutiaux, Hypaetha 321  
*ornatipennis* Schilder, Hypaetha 321  
*ostrina*, new species, Jansenia 194  
*paradoxa* Horn, Oligoma 238  
*parvimaclulata* Fowler, Spilodia 152  
*paucipilina*, new species, Ifasina 274  
*pictus* (Motschulsky), Cyllindera 243  
*plagatima*, new species, Jansenia 192  
*plumigera* Horn, Lophyridia 160  
*pochoni* Mandl, Pancallia 104  
*princeps* Vigors, Pancallia 104  
*prinsepii* Saunders, Eugrapha 291  
*procera* Horn, Eugrapha 289  
*prothymoides* Horn, Jansenia 208  
*psarodea*, new species, Jansenia 212  
*pseudodromica* Horn, Jansenia 180  
*psilica* Bates, Ifasina 326  
*pumila* Dejean, Eugrapha 291  
*quadrilineata* Fabricius, Hypaetha 318  
*quadrinaculata* Mandl, Lophyridia 170  
*quadrinaculata* Sturm, Calochroa 125  
*quadripunctulata* Mandl, Lophyridia 170  
*recta* (Motschulsky), Cyllindera 241  
*reductula* Horn, Ifasina 284  
*regalis* Dejean, Chaetodera 139  
*renardi* Fleutiaux, Lophyridia 158  
*renei* Horn, Hypaetha 318  
*reticulella*, new species, Jansenia 228  
*rhytidopteroides* Horn, Setinteridentia 237  
*rostrulla*, new species, Jansenia 214  
*rugosiceps* Chaudoir, Jansenia 223  
*sandurica*, new species, Jansenia 224  
*seminigra* Fowler, Pancallia 106  
*semisetigerosa*, new species, Jansenia 185  
*semivittata* Fabricius, Spilodia 150  
*seriepunctata* Horn, Ifasina 270  
*severini* Horn, Ifasina 258  
*sempunctata* Fabricius, Calochroa 119  
*shivah* Parry, Pancallia 108  
*sikhimensis* Mandl, Ifasina 283  
*singalensis* Horn, Eugrapha 301  
*sinica* Fleutiaux, Myriochile 325  
*specularis* Chaudoir, Myriochile 311  
*speculifera* Brullé, Myriochile 311  
*speculifera* Chevrolat, Myriochile 311  
*spinolae* Gestro, Ifasina 273  
*spinolai* Gestro, Ifasina 273  
*stellata*, new species, Jansenia 203  
*stoliczkana* Bates, Cicindela 101  
*striatifrons* Chaudoir, Lophyridia 145  
*striolata* Illiger, Spilodia 150  
*stuprata* Horn, Jansenia 217  
*sublacerata* Solsky, Eugrapha 302  
*subtilesignata* Mandl, Ifasina 279  
*sumatrensis* Herbst, Lophyridia 156  
*tetragrammica* Chaudoir, Jansenia 230  
*tetrastacta* Wiedemann, Jansenia 210  
*tremebunda* MacLeay, Eugrapha 291  
*tremula* Audouin and Brullé, Eugrapha 287  
*tridentata* Thunberg, Hypaetha 319  
*triguttata* Herbst, Ifasina 253  
*triramosa* Kollar, Eugrapha 292  
*trisinigra* Dejean, Eugrapha 285  
*tritoma* Schmidt-Goebel, Calochroa 121  
*umbropolita* Horn, Ifasina 264  
*undulata* Dejean, Cicindela 309  
*unica* Fleutiaux, Ancyilia 111  
*venosa* Kollar, Eugrapha 298  
*venus* Horn, Jansenia 216  
*vestiplicatica*, new species, Jansenia 187  
*viduata* Fabricius, Ifasina 253

*vigintiguttata* Herbst, Chaetodera 141  
*vigorsii* Dejean, Spilodia 150  
*virgula* Fleutiaux, Cosmodela 132  
*viridicincta* Horn, Jansenia 221  
*viridilabris* Bates, Ifasina 256  
*viridilabris* Chaudoir, Ifasina 255  
*viridula* Mandl, Lophyra 147  
*viridula* Quenzel, Cicindela 147  
*vittigera* Dejean, Spilodia 154

*waterhousei* Horn, Ifasina 268  
*westermanni* (Schaum), Jansenia 178  
*whithillii* (Hope), Calochroa 120  
*wilkinsi* Dokhtouff, Cicindela 101  
*willeyi* Horn, Ifasina 269  
*xanthospilota* Fowler, Calochroa 126



# INDEX TO VOLUME 58

## CONTENTS

### ARTICLE

1. Observations on the distribution and ecology of the mammals of the cerrado grasslands of central Brazil ..... Michael A. Mares, Janet K. Braun and D. Gettinger 1
2. *Lyreidus alseanus* Rathbun from the Paleogene of Washington and Oregon, U.S.A. .... Rodney M. Feldmann 61
3. A new species of tiger beetle from India (Coleoptera: Cicindelidae) ..... Robert E. Acciavatti and Fabio Cassola 71
4. The tiger beetle genus *Cicindela* (Coleoptera, Insecta) from the Indian subcontinent .... Robert E. Acciavatti and David L. Pearson 77

# NEW TAXA

## NEW GENERA, SPECIES, AND SUBSPECIES

<i>Cicindela</i> ( <i>Plutacia</i> ) <i>notopleuralis</i> , new species, Insecta, Coleoptera, Cicindelidae .....	71
<i>Cicindela</i> ( <i>Cosmodela</i> ) <i>intermedia chitwanae</i> , new subspecies, Insecta, Coleoptera, Cicindelidae .....	134
<i>Cicindela</i> ( <i>Lophyridia</i> ) <i>plumigera macrograptina</i> , new subspecies, Insecta, Coleoptera, Cicindelidae .....	162
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>dasiodes</i> , new species, Insecta, Coleoptera, Cicindelidae .....	181
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>semisetigerosa</i> , new species, Insecta, Coleoptera, Cicindelidae .....	185
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>vestiplicatica</i> , new species, Insecta, Coleoptera, Cicindelidae .....	187
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>legnotia</i> , new species, Insecta, Coleoptera, Cicindelidae .....	190
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>plagatima</i> , new species, Insecta, Coleoptera, Cicindelidae .....	192
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>ostrina</i> , new species, Insecta, Coleoptera, Cicindelidae .....	194
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>corrugatosia</i> , new species, Insecta, Coleoptera, Cicindelidae .....	196
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>cratera</i> , new species, Insecta, Coleoptera, Cicindelidae .....	198
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>cirrhidia</i> , new species, Insecta, Coleoptera, Cicindelidae .....	201
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>stellata</i> , new species, Insecta, Coleoptera, Cicindelidae .....	203
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>choriodista</i> , new species, Insecta, Coleoptera, Cicindelidae .....	207
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>psarodea</i> , new species, Insecta, Coleoptera, Cicindelidae .....	212
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>rostrulla</i> , new species, Insecta, Coleoptera, Cicindelidae .....	214
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>fusissima</i> , new species, Insecta, Coleoptera, Cicindelidae .....	218
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>sandurica</i> , new species, Insecta, Coleoptera, Cicindelidae .....	224
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>reticulella</i> , new species, Insecta, Coleoptera, Cicindelidae .....	228
<i>Cicindela</i> ( <i>Jansenia</i> ) <i>applanata</i> , new species, Insecta, Coleoptera, Cicindelidae .....	231
<i>Cicindela</i> ( <i>Glomera</i> ), new subgenus, Insecta, Coleoptera, Cicindelidae .....	233
<i>Cicindela</i> ( <i>Glomera</i> ) <i>ochrocnemis</i> , new species, Insecta, Coleoptera, Cicindelidae .....	235
<i>Cicindela</i> ( <i>Ifasina</i> ) <i>cyclobregma</i> , new species, Insecta, Coleoptera, Cicindelidae .....	251
<i>Cicindela</i> ( <i>Ifasina</i> ) <i>collicia</i> , new species, Insecta, Coleoptera, Cicindelidae .....	259
<i>Cicindela</i> ( <i>Ifasina</i> ) <i>umbropolita lucidinigrosa</i> , new subspecies, Insecta, Coleoptera, Cicindelidae .....	265
<i>Cicindela</i> ( <i>Ifasina</i> ) <i>melitops</i> , new species, Insecta, Coleoptera, Cicindelidae .....	271
<i>Cicindela</i> ( <i>Ifasina</i> ) <i>paucipilina</i> , new species, Insecta, Coleoptera, Cicindelidae .....	274
<i>Cicindela</i> ( <i>Ifasina</i> ) <i>limitisca</i> , new species, Insecta, Coleoptera, Cicindelidae .....	276
<i>Cicindela</i> ( <i>Ifasina</i> ) <i>anelia</i> , new species, Insecta, Coleoptera, Cicindelidae .....	281
<i>Cicindela</i> ( <i>Eugrapha</i> ) <i>ancistridia</i> , new species, Insecta, Coleoptera, Cicindelidae .....	296

# AUTHOR INDEX

Acciavatti, R. E. ....	71, 77
Braun, J. K. ....	1
Cassola, F. ....	71
Feldmann, R. M. ....	61
Gettinger, D. ....	1
Pearson, D. L. ....	77







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